MARKETING COMPETITION IN SPECIAL ECONOMIC ZONES IN CHINA - THE CASE OF LPG

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ABSTRACT

Special Economic Zones (SEZs) were set up in 1979 in China to 'experiment' new economic approaches and test the applicability of these new approaches to China. SEZs are open to foreign investors, most of whom have no previous experiences in this virgin market. It becomes more and more critical for the foreign investors to review the investment environment as the intensity of competition becomes acute and the capital commitments become heavy.

In this thesis the case of LPG marketing in SEZs is studied. There are three core questions to which we address:

How do the competing companies define the market ?

What marketing strategy is appropriate to this market ?

What are the factors that determine the performances of the competing companies ?

These questions will be examined one by one. Theoretical framework for analysis is set up in the light of previous researches in experience curve effects and profit impact of market share.

The LPG industry in SEZs is still at its early stage of development. Empirical data drawn from them are too scattered and too 'turbulent' to warrant meaningful analysis. An analog similar to the SEZs in critical aspects was selected and empirical data about the sales volumes, cost structures and market share positions of the analog were collected and analysed. It is postulated that conclusions drawn from the analysis of the data collected from the analog can be applied to SEZs. The validity of this assumption depends very much on how closely the analog resembles the SEZs. In this study Hong

Kong was selected as the analog for a few reasons. Some of the major justifications are:

(1) SEZs are built on the successful model of Hong Kong. Business environment in SEZs will resemble Hong Kong more than other Chinese cities.

(2) The same foreign oil companies compete in SEZs and in Hong Kong.

(3) Applications of LPG in the SEZs and in Hong Kong are similar, especially in the domestic sector.

(4) SEZs are in the proximity of Hong Kong and much influenced by the latter in many aspects.

Having analysed the data, we arrive at the following conclusions for the LPG market in Hong Kong, the analog for the SEZs:

(1) All the competing companies define the LPG market in the same way.

(2) The only appropriate strategy is overall cost leadership, i.e. to achieve a low unit cost position.

(3) The higher the cumulative sales by a company, the lower the unit cost becomes.

(4) A company with a higher market share in the whole LPG market will achieve a higher performance.

The conclusions are extended to the SEZs. Thus these findings have great managerial implications for the LPG marketers in SEZs. Specifically, they suggest that:

(1) the company who succeeds in securing the highest cumulative sales volume in the SEZs will have the promising result of achieving the lowest unit cost. In the long term it will be more profitable than its competitors.

(2) if a company is in pursuit of an above-average performance,

then it should move strategically into a high market share position in the total LPG market in the SEZs (that is, not only in a particular sector of the business).

Analysis of the Hong Kong data also indicates that the market share positions are related to the amount of asset employed. The relative positions were formed at the early stage and would remain fairly stable thereafter.

It is projected that the same phenomena will be observed in the SEZs in the future. Thus, it becomes necessary to assemble adequate amount of asset and move quickly to occupy a lion's share of the market in the very beginning.

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ACKNOWLEDGEMENT

It is a bitter yet memorable experience for many an MBA candidate in writing the master thesis, especially for a part-time student who has accustomed himself to the commercial world that tends to encourage people to sacrifice the details of rigid theoretical deductions in order to give a volley-kick to the goal. Bitter because of the long process and the many sleepless nights in struggling to surface an ocean of academic jargons and to wedge through a thinking path that has not been trespassed upon; and memorable because of the continual concerns and valuable advices from my colleagues and especially my advisor, Dr. Lee Kam-hon of Department of Marketing and International Business, The Chinese University of Hong Kong. Throughout the preparation of this thesis, Dr. Lee has been supervising my work closely. In the Chinese saying, he has been a 'life-buoy' that must have been much troubled by my grasping it so often.

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CHAPTER I

INTRODUCTION

China is a country with a long history, but has closed her doors to the outside world for many a century. After the founding of the People's Republic of China in 1949, there was a short period of open policy to Soviet Union and East European countries during the First Five Year Plan. After that internal power struggles have led China into a period of unrest and consequently China closed her door again. With the death of Mao Zedong and the fall of the Gang of Four, China's policies have undergone tremendous changes; the question of whether China should open herself to the outside world was raised. It was finally resolved that in order to modernise the country, China can no longer keep her doors closed. The leader of China, Deng Xiaoping, is well aware of the significance of an open policy. He remarked that isolation would prevent any country's development, and it will be absolutely impossible to approach the level of the developed countries in 50 years.[1] He commented in another occasion that "after summing up the historic experience, we come to see that closing the country to the rest of the world for a long time is an important factor leading to China's stagnation and backwardness. Experience has proved that to build a country, with its door closed will not end in success and China's development can by no means be separated from other countries in the world. It's

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[1]Chairman Deng Xiaoping's speech at the Third Plenary Session of the Central Advisory Commission on 22nd October, 1984.

true that such a big country as China can go nowhere unless it relies on herself, which we refer to as a policy of self-reliance. Nevertheless, while we stick to self-reliance, we must open our country to outside world and attract foreign capital and technology to facilitate our development."[1]

The pragmatic approaches of Deng Xiaoping to develop China were summarised in his two themes: 'revitalizing the domestic economy' and 'opening to the outside world'. He trusts that only when these two themes are followed is it possible to modernize China. He has set a target for his country to quadrupling the GNP by the end of the century and to approach the level of the economically developed countries within another 30 to 50 years. With this ambitious target "the policy of opening to the outside world was put forward after careful consideration having summed up both experience and lessons in domestic construction and analyzed political and economic situation in the world. It is not an expedient measure but a long-term and basic state policy" (Almanac of China's Foreign Economic Relations and Trade 1985).

As early as in 1979 a decision was made by the Central Committee of the Chinese Communist Party and the State Council to introduce a new scheme of economic management in the provinces of Fujian and Guangdong to give full play to the advantages of their special positions, being close to Hong Kong and Macao and the home provinces of many overseas Chinese. Under such a scheme, four special economic zones (SEZs) were set up in Xiamen, Shenzhen, Shantou and Zhuhai. In these zones greater flexibility and autonomy were granted in their economic activities involving foreign capital

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[1]Chairman Deng Xiaopiang's speech to representatives taking part in the Symposium on China and Foreign Economic Cooperation on 6th., October, 1984.

and technology, which were not enjoyed by other cities in China. The official objectives of such a movement was clearly noted in the Regulations on Special Economic Zones in Guangdong Province approved by the 15th Session of the Standing Committee of the 5th National People's Congress on 26th August,1980: "Certain areas are delineated from Shenzhen, Zhuhai and Shantou in Guangdong Province to form special economic zones in order to develop external economic cooperation and technical exchanges and promote the socialist modernization programme." What have not been mentioned in the regulation is the underlining rationale in this strategic move.

Significance of SEZs to China

Many observers have posed the questions: "Open policy is implemented all over China. Why do the Chinese still establish the four SEZs ? What are the underlining implications to the future development of China ?"

The answers were provided by Gu Mu, secretary of the Party Central Committee and State Councillor in a speech on 30th October, 1984,"...First, they (the four SEZs) have unique geographical locations, especially Shenzhen and Zhuhai which are next to Hong Kong and Macao. Hong Kong is an international trade and banking centre. There are great advantages to set up the SEZs in the places close to Hong Kong for absorbing foreign capital, importing advanced technology, expanding foreign trade, obtaining international information and studying contemporary capitalism....Second, we may try to explore experience for the reform of China's economic structure by establishing the SEZs. The reform of economic structure must be carried out cautiously because a slight move in one part may affect the situation as a whole. However, bigger step can be taken in the SEZs where we can freely

conduct the experiment of reform in line with what comrade Hu Yaobang put forward: 'New things should be handled in a new way, special things in a special way; while keeping our stand unchanged, we should resort to completely new methods.' In this way, it is not only conducive for us to explore new approach for quickening the pace of economic development and spread successful experience to the interior regions but also to confine unsuccessful experience from the experiment within a limited area....In Shenzhen, when a high-rise building is erected, one storey can be completed in six or seven days. The construction progress and quality can match that of Hong Kong. This experience has been spread to the whole country. Shenzhen also reformed its labour and personnel system, practising labour contract system, floating wage system and system of advertising for cadres, which also achieved good results....Third, it is of great political significance to establish the SEZs. The general opinion abroad holds that to set up the SEZs is a bold action and creative decision of the Chinese leaders dedicating themselves to the modernization."

SEZs are therefore meant to be "geographical laboratories where Western economic concepts are being tested. Unlike export processing zones of developing countries, the 'experiments' conducted in China's special economic zones are not confined solely to industrialization but also to other economic activities ranging from primary production to tourism, real estate development and various kinds of service industries. In the case of Shenzhen, for example, the amount of capital invested in manufacturing industry was 16 per cent in 1981, compared with 40 per cent in real estate development and 28 per cent in tourism." (Wong 1982)

In order to facilitate the development of the SEZs, special laws

and regulations were specially drafted for these zones (see appendix 2). These regulations associate strongly with those in free market economies like Hong Kong where every enterprise has to manage his own business with minimum government intervention. They resemble none of the regulations prevailing in other regions in China where the predominant guide-line is planned economy leading to limited autonomy in individual production units. For example, in a typical Chinese factory all the labours and administrative staff are assigned by the government. The institution cannot refuse to accept or request for more. Nor can they terminate the employment of existing workers. The determination of the Chinese government to carry out the 'experiment' illustrates that they are probably in doubt of the prevailing system and believe the SEZs model would be suitable to apply to the whole country in the future.

The results achieved by the SEZs in the last few years had probably strengthened their thinking. Song Ping, the State Councillor and Minister in charge of the State Planning Commission reported on the draft 1984 plan for national economic and social development on 16th May, 1984: Shenzhen, Zhuhai, Shantou and Xiamen Special Economic Zones signed over 1,400 various economic projects with foreign business in 1984, with a total investment volume amounting to 900 million US dollars. The actual funds invested in the year were over 330 million US dollars. During the period from 1979 to the end of 1984, these four special zones had signed more than 4,000 agreements of various economic co-operations. The agreed volume of investment was over four billion US dollars, and the actual investment was over 800 million US dollars. The gross industrial and agricultural production value reached 3.34 billion yuans, up 62% as compared with 1983.

The composition of the foreign partners also experiences changes. In 1981, 91% of the total investment committed in the Shenzhen SEZ (which was the largest SEZ in terms of investment) came from Hong Kong , and only 9% from overseas Chinese and non-Chinese foreign investors(Economic Reporter, 11th November, 1981). In 1984, according to Song Ping, the total investment funds from American, West European and Japanese investors accounted for 35% of the total foreign investment funds in China.

We can summarise the characteristics of the SEZs as follows:

(1) The economic development in SEZs will basically follow the experience of developed areas and is substantially different from the conventional development model in China. It is regarded as an experiment with two obvious alternative outcomes: If it is successful, that it can help China achieve its modernisation programme without adversely affecting the theoretical framework of the socialism practised by the Chinese government, it will become the model for the future economic development of the whole country. If it is not successful, that the adverse effects outweigh the benefits, China will probably abandon the SEZ approach. It is unlikely however that China will totally abandon her persuit in outreaching to the outside world. Rather, the mistakes committed in SEZs will be evaluated and adjustments made before conducting other 'experiments'. Deng Xiaoping has remarked that SEZ is a window, a window of technology, a window of management, a window of knowledge and a window of implementing foreign policy. He implied that the knowledge and management expertise learnt are beneficial to the country from long-term point of view. The message is: Whether SEZs will be successful

or not, any analysis about the running of SEZs will promote an understanding of the development trend of China, and will be able to apply to the future studies about China.

(2) SEZs are not likely to be a product of transient conceptual realisation of the contemporary Chinese leaders. Rather, the determination of the Chinese leaders to modernise China makes it highly likely that the economic development in SEZs can be perceived in a time frame of decades. It is important that SEZs are set in this long time frame so that the economic activities now taking place in SEZs can be evaluated and projected along a developmental perspective.

(3) The economic environment in SEZs is substantially different from that in other parts of China and can be studied separately. We have noted that the investments in SEZs are by and large funded by foreign sources as different from the majority parts of China. The economic setting is also widely deviating from what is currently experienced in non-SEZs areas; labour systems are different, tax treatment is new, and foreign exchange arrangements are tailored to the need of SEZs. Our experience with the non-SEZs regions can no longer be employed to make any sensible inference to the phenonmena observed in SEZs.

(4) The infra-structures are constructed based on foreign models. Visitors to SEZs are often amazed by the great contrast between the SEZs and other Chinese cities in the facilities and efficiencies in areas like transportation and communications. On the other hand, these more advanced features will reflect what future China looks like.

(5) As foreign technologies and management are widely practised in

SEZs, the marketing environment in SEZs resembles more to developed areas than non-SEZs regions in China. Some foreign business habits are also introduced, for example, the award of contracts based on tender bids. This reflects an enhanced autonomy enjoyed by the enterprises in SEZs.

From the above accounts it is clear that SEZs have great bearings on the future development of China. The importance of studying the marketing environments in SEZs is directly linked to the significance of SEZs in the pursuit of China for modernisation. An understanding of how the marketing forces interact in SEZs will give great hints of how these forces can be manipulated in the future China, which is a huge potential market hitherto unknown to the rest of the world.

LPG in SEZs

LPG (Liquefied Petroleum Gas) is widely used in the world as domestic and industrial fuels. A brief description of its properties and applications is noted in Appendix 3.

In China, LPG has also been known for some time but its use is limited to a tiny portion of the population because of its scarce supply. The quality of LPG produced is also questionable due to the backwardness of the refinery facilities and the quality of the crude oil. The sales volume of LPG from local source is thus not significant in the past. The future picture is quite uncertain as the local supply depends on two factors. The first factor is the overall production of LPG in China. This is an unknown factor but judging from China's commitment in the oil explorations the production will definitely rise. The second one is the proportion of LPG allocated to the area. We note that China on the whole is practising planned economy. The local supply of the petroleum products will not follow

the rule of the market forces. It is some sort of quota fixed over a period disregarding whether it can meet with the demand or not.

In SEZs, the supply situation is not quite the same as in other regions. In the first place they being SEZs are allocated a higher portion of quota than the rest of the country. Secondly due to their proximity to Hong Kong LPG is imported to these areas from the foreign oil companies based in Hong Kong. The latter is of higher quality and has abundant supply. The price is also higher. People in SEZs on the average enjoy higher wages and thus can afford this imported product when the local supply is short. In the SEZs it can be observed that most of the families have abandoned the traditional fuels, coal and wood, and switched to LPG. As for industrial users, they are quite willing to pay more for a steady supply and for a better quality that minimise their maintenance costs.

The same buying behaviour can be observed in SEZs in many other products like electronic goods and clothes. There is one common phenomenon: people are willing to pay for substitutes that give better qualities, greater comforts and more convenience when their living standards improve.

LPG is a typical example of a product that is superior to its substitutes (coal, wood and kerosine alike) in its cleanliness, easy handling and strong flame, but with a higher price. In many aspects it is one of the consumer goods in the eyes of domestic users. On the other hand, it is also one of the industrial goods for industrial users who often regard it as a substitute for other fuels used in their production processes.

The marketing competition of LPG in SEZs will thus be typical for products with the above characteristics, which are shared by

many consumer and industrial goods produced in foreign countries and pushed into the potential market of China. A common concern of the foreign companies is how fast China will pick up the technical know-hows to produce these products herself and sell to the market, presumably at a lower price either due to lower costs in raw materials and labour or government subsidy. While this concern is an important consideration, any future impacts by the Chinese invasion into her own market will have equal effect on the foreign companies.

We can thus identify two different groups of supply sources of LPG (and also other goods) to the China market: the local supply and the foreign supply. Local supply is characterised by fixed price and fixed quota. Foreign supply is on the other extreme: Price is not fixed, and supply quantity is abundant. We have to distinguish carefully the two sources of supply and when we discuss the market competition in the following paragraghs we are referring to the foreign suppliers who are very much different from the local suppliers in the following aspects:

(1) They can determine for themselves how much to sell, to whom and at what price.

(2) They secure their supply of LPG from the world market. If demand is large, they can easily order for more supply.

(3) They have to bear the profit or loss of their operation. They have to study their markets carefully, decide what investment to put in, how to fight against his competitors, and how to gain overall competitive advantage.

In summary, though China is an oil producing country, much of the local demand is met with by foreign supplies due to limited quota available to fulfil local needs. A window is open to these foreign

companies, though the width of the window is uncertain. One thing to be sure of is: whatever changes in the local supply scenario take place, all the foreign oil companies will be equally affected, unless some form of joint-venture is developed that gives preferential treatment to one company over another. Again, the opportunity to link structurally with the SEZ authorities is open to all the foreign oil companies. Thus the linking itself is the result of marketing strategy rather than a cause of difference in performance.

Our research on the marketing competition of LPG in SEZs will be limited to the foreign oil companies. Though the uncertain element of local supply is not included, we can regard the market under discussion as the difference between the total LPG market in the SEZs and a fixed deduction absorbed by the local supply. The resultant market will have an extra element that causes its overall expansion or contraction.

Marketing Competition of LPG in SEZs

In studying the marketing competition of LPG in SEZs we need to examine what the sales figures of LPG in SEZs were during the past few years. In 1984, the annual sales in SEZs amounted to 801 metric tons, compared with 678 metric tons in 1983 and neligible amount in 1982. Not much can be concluded from these figures, as can be expected in a market where a new product is being introduced.

In the absence of direct data the concept of employing an analog is extremely useful. An analog is a place which resembles closely to SEZs in the marketing environment and bears the significant features of SEZs that affect the marketing competition. On the other hand, it must be a place in which the history of marketing LPG is long enough to accummulate adequate data for

analysis. Should such an analog exist, we can analyse the data of the analog, draw conclusions from the data and apply the conclusions in predicting the behaviour of the marketing forces in SEZs.

One obvious candidate of the analog is Hong Kong. Before we examine the qualification of this candidate in detail let us first review the special features of SEZs that distinguish from the rest of China. Gu Mu, the secretary of Party Central Committee and State Councillor, made the following comments in a speech on 30th October, 1984, "When we say they are special, we mean that they are practising 'special' economic policies and economic management system. We will deal with the matter more concretely in the following four points:

(1) The economic development of the SEZs mainly relies on using foreign capital. Complex economic system is practised under the leadership of socialist economy in the SEZs where entities such as Sino-foreign joint ventures, cooperative management and enterprises with exclusive foreign investment co-exist simultaneously with state, collective and individual enterprises. This is different from the interior regions where the economic system of enterprises owned by the whole people prevails.

(2) Market regulation plays an important role in the economic activities of the SEZs under the guidiance of socialist planned economy. This is also different from that of the interior regions.

(3) Special preferential treatment and convenience are given to foreign investors in taxation, royalty, entry and exit control. Generally speaking the SEZs are more open than the interior regions.

(4) The state gives more self-governing power to the SEZs in their

economic activities, for example, the governments of SEZs have the right to approve any construction project under RMB 50 million yuan for heavy industry and under RMB 30 million yuans for light industry provided that they do not need the overall balance of construction plan by the state. The target of capital construction may not be included in the target controlled by the state, it can be dealt with separately. General speaking, the self-governing power of the SEZs in this respect is bigger than the power at province level."

These features have shaped the broad marketing environments in SEZs and can be compared with those in Hong Kong. A brief introduction of the development of Hong Kong that follows will help clarify this.

Hong Kong

Hong Kong is located at the South-Eastern part of China next to Shenzhen. Its prominent location in South-East Asia makes it one of the most prosperous international city in the world. It is the third largest financial centre after New York and London. More than five million people, over 98% being Chinese, live in this place with a total area of about 400 square miles.

The development of Hong Kong can be traced back to the mid-nineteenth century when Great Britain took over part of Hong Kong from China after the signing of the Nanking Treaty. By the end of the nineteenth century the remaining parts of Hong Kong were also conceded to Britain following the Peking Treaty. During the early years under the British rule, Hong Kong remained as a fishing village. There were some trading activities by merchants coming from China and South-East Asia, but not much development in those days.

After the turn of the century, Hong Kong gradually developed itself into an entrepot. In 1949, China fell into the hands of the communists, and the Peoples' Republic of China was formed. Many Chinese entrepreneurs then fled into Hong Kong in fear of the communists. They brought with them the necessary capital and technology to turn Hong Kong from an entrepot to a rudimentary industrial city. Entrepot trade still flourished, especially during the Korean War when the States enforced an embargo against China which was alleged to be involved in the war and large quantities of material were delivered to China via Hong Kong at that time.

The economy of Hong Kong was gradually developed. Factories were built up and there was plenty of labour available when innumerable refugees rushed to Hong Kong. Cheap labour, available technology and capital technology imported by the Chinese have attributed to the sound foundation on which Hong Kong built up its economy.

In early 1970's, Hong Kong has experienced a great recession like other parts of the world. But Hong Kong had a quick recovery. The 1970's has witnessed Hong Kong gradually transformed itself from its bias to labour intensive industries to those required higher technologies. It also gradually developed itself in the financial activities and in the diversification of industry.

The Hong Kong Government also plays an important part in the development of Hong Kong. The policy of lassie-faire is adopted in which the government has very little intervention into the private sector. In 1984/85, the government expenditure is only HK$36.90 billion (less than 15% of the GDP), to be allocated to education, social welfare, housing, internal security, medical care and public works. Tax is low at 18.5% for corporations, and there is no import

tax except for tobacco, alcohol, car and other luxuries. Government has little intervention in the market, allowing the market mechanism to fully operate.

Hong Kong has a very stable political environment. The law system basically follows closely the common laws. Western education styles were introduced. Except for highly specialised personnels, Hong Kong is self-sufficient in its requirement of professions and labour.

The GDP in Hong Kong in 1984 is HK$250 billion, which is about 2.5 times that in 1975 in real terms. The total exports of goods and services in 1984 was HK$266 billion, revealing that Hong Kong is heavily relying on exports to finance its activities.

Hong Kong As An Analog

The above gives a broad outline of the background of Hong Kong on which the marketing environments are shaped. The question of using an analog will be discussed next.

From the very beginning of the development of SEZs, Hong Kong has been closely involved. In the first place it would be quite impossible to fully understand SEZs without a closer look into Hong Kong on which SEZs are, at least partly, modelled. The involvement of Hong Kong Chinese at the early development stage of SEZs has undoubtedly brought with them their perception of the market and the way business was conducted by them. Even the life-styles, ideologies and norms of Hong Kong have greatly influenced SEZs through increased personal contacts, TV programmes, radio broadcasts, publications, tapes and videos. Due to their proximity to Hong Kong, TV programmes and radio transmissions can be perfectly received. In the past the Chinese government had produced background noise to interfere with these transmissions so

that her people would not be 'polluted', but such interference has been removed.

Influence by Hong Kong is evident by the emergence of local pubs in which hit songs originated in Hong Kong are sung by local singers, by the imitating way of the locals in dressing and hair styles, by the way restaurants are operated and by the locals' zealous enquiry about Hong Kong movie stars.

Another significant factor concerning the competing parties of LPG supplies is that LPG is marketed in SEZs by the same major oil companies who have bases in Hong Kong. With the establishment of the SEZs that allows foreign companies to set up branch offices and conduct business, these oil companies start to rush into these areas and compete with each other. As the domestic production of LPG in China is far below the minimun level that satisfies the need of the population, the oil companies discover that SEZs are the promising markets for their products. We should note that the same companies compete with each other, though in a different market. A close look into the home base of these oil companies will help understand their behaviours on the one hand and will also provide clues for studying the marketing competition in SEZs on the other hand.

To sum up, the justification of adopting Hong Kong as the analog is much associated with the following observations:

(1) SEZs are much influenced by Hong Kong in the ways that business is conducted and it is not too far off that they are constructed based on the successful model of Hong Kong.

(2) As observed above, it is the same foreign oil companies who compete in SEZs. Their experience in Hong Kong will inevitably be reflected in their strategies employed in SEZs.

(3) The product, LPG, is new to SEZs, as it was new to Hong

Kong in 1962 when it was first introduced. The oil companies are now facing more or less the same decision problems in SEZs as what they had faced in Hong Kong before, except probably the political complication that SEZs is under China's jurisdiction. No one can be totally sure that China will not modify her policy, but from what has happened, it is reasonable to assume that SEZs are going concerns. The special regulations governing the running of SEZs resemble more to the laws in Hong Kong than anything else. Thus, it strengthens our claim that the oil companies are probably tackling the same entry problem as they did before in 1962.

(4) Most of the population in Hong Kong are Chinese, bearing the same cultural heritage as the Chinese in SEZs. One obvious example is that both prefer food to be cooked in naked-flame.

(5) Decision on what fuel to be used etc come from the investors. Incidentally many investors in SEZs are Hong Kong citizens.

(6) Since SEZs are in the proximity of Hong Kong, supply of LPG to these regions by the oil companies in the short term will most likely be delivered from the depots in Hong Kong. It resembles delivery to a sub urban region within Hong Kong, except some custom formalities to be cleared at the border. In the longer term sub-depots will be built in SEZs using similar equipment and employing similar contractors. The cost structure of selling LPG to SEZs will closely correspond to inland sales in Hong Kong.

(7) LPG was introduced into Hong Kong in 1962. Over the years a series of sales data have been accumulated and available for analysis.

The oil companies will inevitably experience some differences in

marketing LPG in SEZs compared with Hong Kong. There are three areas that arouse most concern:

(1) Relationship management. The way that business decisions are made in China differs substantially from Hong Kong. Very often a simple decision in procurement which can be made by a single person in a Hong Kong firm will require the consensus of several persons in a firm in China. There may appear no single person who can say a definite yes or no. It becomes important for the Hong Kong suppliers to know their decision paths, and to get familiar with the Chinese officials personally in order to secure a supply contract. The success of the business depends partly on how well the sales people handle their relationship with the Chinese officials.

The same experience is shared by many foreigners in conducting business with the firms in China. It comes as a cultural shock to these business partners when they are first exposed to the business behaviours of these firms. It is not unreasonable to project that with the passage of time the different ways in which business is conducted will tend to merge when the foreign partner gradually learns more about the 'business culture' of the firms in China while the latter adopt more and more of the conventions practised by foreign countries.

(2) Foreign exchange. China is tightening her control over the spending of foreign exchange. This arouses considerable concern especially by those foreign investors who require foreign exchange to pay for raw materials and equipment. For LPG the impact is minimised because of the load can often be passed to the consumers, especially the industrial users. It

would not be as easy for domestic customers. It implies the oil company has to monitor carefully the proportion of its earnings in local currency and foreign exchange. As part of the operating costs can be paid in local currency, it is possible to achieve a balanced budget for a sound financial planning.

(3) Political instability. Some people worry that the stable political environment in the SEZs could be upset when they review the history of China in the past twenty years.

As every business has its inherent risk factors, the investors would expect different returns from different business segments to reflect the risk factor. It will probably imply that oil companies expect a higher return from their investments in SEZs than in Hong Kong. But it will not affect the nature of competition amongst the competitors who are all faced with the same situation.

While it is true that the marketing environments in SEZs are not exactly the same as in Hong Kong given the above differences, the essential elements in these two regions resemble each other closely. It is clear that unless analog is not used, which is highly undesirable in view of the very few data available and the transient nature of these data at the initial product introduction stage, Hong Kong is the best candidate.

CHAPTER II

LITERATURE REVIEW

Business Definition

It is not new to argue that the starting point for strategic planning is business definition. About two decades ago, Seymour Tilles noted (1969): " the problem of carefully defining an individual business has been discussed at great length in the business literature, especially by Peter Drucker and Theodore Levitt. Both have stressed the significance of starting with a definition of the major businesses of the company as a point of departure in strategic planning." In the late seventies, Derek F. Abell made a number of studies in this area and formulated a framework in which various businesses can be fitted in (Abell 1980). He started by posing a number of problems associated with a lack of an adequate set of concepts for defining a business :

(1) How should we conceptualize business definition ?

(2) How should we conceptualize changes in business definition ?

(3) What factors should be considered when choosing a particular definition of a business ?

(4) How does the question of definition vary with organizational level ?

(5) How is individual business definition related to market boundary definition ?

(6) How do market boundaries get redefined over time ?

These problems are of concern to practising managers. Abell

quoted the example of Xerox shifting from copier business to automated office system as a result of strategic redefinition of Xerox's activities. Once the business is defined, there are related strategic questions. For example, how are decisions about objectives to be made consistent with a particular definition ? How are functional strategy decision, marketing, manufacturing, R&D, service, distribution, and so on, related to definitional choices ? On the organization and planning level, there are also several organizational questions derived from strategic definition of the business. For example, how should the business unit be defined organizationally ? How should programmes of activity within each business unit be defined ? Further, the application of several formal aids to strategic planning like PIMS (Buzzell, Heany and Schoeffler 1974) requires the business to be defined explicitly before the method can be used.

Conceptualizing the Definition of a Business

Abell comments that the conventional definition of a business along two dimensions, namely, product and market, is inadequate. He suggests that a business may be defined in three dimensions, namely, customer groups, customer functions and technology. Customer groups describe categories of customers, or who is being satisfied. Customer functions describe customer needs, or what is being satisfied. Technologies describe the way, or how customer needs are satisfied. A business has its own scope and degree of differentiation along these three dimensions. Scope and differentiation thus define the business.

Scope

Customer Group

Customers are divided into groups according to their identity

being differentiated by geography, user industry, size, etc.

Customer Function

Products or services perform certain functions to the customer. Some cautions are required to distinguish function from the way the function is performed and the attributes or benefits associated with the function. For example, teeth cleaning is a function; fluoride toothpaste and regular toothpaste are ways of performing the function; flavour, brightness and price are attributes associated with a particular purchase.

Technology

It describes the different ways that a function can be performed. One important feature of technology is its dynamic nature: one technology can be displaced by another over time. In assessing the scope of the technology, the customer perspective is vital. Failing to realize this may miss out possible alternatives. For example, teabags might be regarded as a technological alternative to loose-leaf tea; but from a customer's perspective, the relevant solutions might be regarded as tea and coffee.

A company may have a wide scope along any of the three dimensions, or it may choose to narrow its scope along a certain dimension.

Differentiation

Scope alone cannot fully describe the business. Abell comments that differentiation is another important parameter.

Differentiation takes two meanings. Differentiation across segments is a measure of the degree to which any individual supplier treats segments of his activity differently; while differentiation across competitors is a measure of the difference between the offerings of competing suppliers. Differentiation can occur across

each of the three dimensions of customer groups, customer functions and technologies. It may be achieved in either variation in the physical product itself, or by variation in some element of the firm's marketing strategy. It occurs in response to differences in customer needs.

The interaction between scope and differentiation can be complex, but can be conceptualised in terms of a typology of business definitions in three alternative strategies: a focused strategy, a differentiated strategy and an undifferentiated strategy. These combinations are shown below:

Differentiation

Scope	Differentiated	Undifferentiated
Narrow	FOCUS	/
Broad	DIFFERENTIATED	UNDIFFERENTIATED

A business may choose to focus on a particular customer group, customer function, or technology segment. Alternatively, it may combine broad scope with differentiation across any or all of the three dimensions. In this case it is said to have taken a differentiated strategy. Or, a company may combine broad scope across any or all of the three dimensions with an undifferentiated approach to customer group, customer function, or technology segments, following an undifferentiated strategy. We can therefore define a company's business into one of 27 categories. It may be:

(1) focused, differentiated, or undifferentiated across customer groups;

(2) focused, differentiated, or undifferentiated across customer functions;

(3) focused, differentiated, or undifferentiated across technologies.

Though there are different possible strategies a company can adopt, very often a company is not free to do so. There are constraints. Two factors in an industry will significantly constrain the choice of the strategy (Day 1984). The first factor is customer price sensitivity. A product that is expensive or is a large element of the customer's budget will assume a high price sensitivity. In the reverse case the sensitvitiy is low. The second factor is the customer's perceived differentiation amongst products in the market. That is, the extent to which a significant difference is present between competitive products, a difference that the customer is willing to pay for.

Market Boundary Definition

From the individual definition of a business we can move on to the next level, the market definition. We can categorize markets into five major types:

(1) All major competitors pursue focused strategies on the three dimensions. One example is scientific instrumentation. Competitors will treat this business independently of their other businesses. Successful firms are likely to be those with a high share of the particular segment involved.

(2) All major competitors pursue focused strategies on one of the three dimensions but have differentiated or undifferentiated strategies on the other dimensions.

(3) All major competitors pursue focused strategies on two of the three dimensions but have differentiated or undifferentiated strategies on the third dimension.

(4) All major competitors pursue differentiated or undifferentiated strategies on all dimensions.

(5) In the preceding four types of markets, competitors though

taking on different strategies define the business homogeniously. In the fifth type different competitors define their businesses differently. For example, some competitors will satisfy a broad set of functions in a narrow set of customer groups; other competitors will satisfy a narrow set of functions in a broad set of customer groups.

The market boundary concept has direct bearing on the measurement of market share. Market share measurement is straightforward when the business definitions of individual competitors are identical. But when competitors are differently defined, 'market share' can take on a variety of meanings, depending on which market definition is used. Great caution has to be exercised in interpreting the figures.

The LPG Market

The LPG market in Hong Kong and SEZs can be analysed using the framework developed by Abell. It is important that the market boundaries of the LPG market can be identified so as to facilitate subsequent discussions. Each of the three dimensions of customer groups, customer functions and technology will be examined.

Customer groups

The customer groups of the LPG market can be divided into five main categories:

(1) Domestice users (packed): These are customers using packed LPG for cooking and water heating. In Hong Kong, the majority of LPG is consumed by this sector. In most of the cases the housewives will decide which brand of LPG is to be used and will place order with the nearby LPG distributors.

(2) Domestic users (bulk): These are residents of large domestic developments in which mini-storage tanks are installed to bring

vapour LPG to every resident through LPG pipes. The right to supply LPG to these developments was assigned to a particular oil company at the very early phase of the development when the developer signed an agreement of concession with the oil company. The exclusive right of supply usually lasted for a period of ten to twenty years, renewable upon expiry. The oil company will give a premium to the developer or some other forms of giveaways to enhance the sales value of the domestic units (e.g. installing a water heater in each of the domestic unit free of charge) in exchange for the concession. Once the oil company has secured the supply contract, the residents will be locked to this particular oil company for the whole period.

The last few years have witnessed two incidents that have greatly encouraged oil companies to compete fiercely in this sector by offering higher and higher premia to bid for the supply contract. The first incident was the announcement by the Government in 1984 of her intension to phase out cylinder LPG in the future. The cylinder business is the lion's share in the LPG business and so if Government proceeds with her plan the oil companies will be severely affected. The second incident was the invasion of towngas network into existing housing estates which are very large outlets of the cylinder LPG. There is a noticeable shift of the oil companies from their previous emphasis on packed sales to bulk sales. Their eagerness to enter into the China market is also aroused by these two incidents.

(3) Industrial users: More than half of these customers are bulk LPG users. They may have special applications of LPG and require close attention from the supplier. For example,

two-piece aluminium can manufacturers use LPG flame to cure the inner lining of the cans. Temperature control is very crucial. In the textile industry, raw cloth is allowed to pass through a line of LPG flame to burn off the excess fibres to produce a smooth cloth surface. The speed of the cloth and the height of the flame tips must be carefully adjusted. Too high a flame tip may result in excessive heat that burns off the whole cloth.

Large discounts are usually granted to these customers because they may consume very large quantity of LPG. In a particular case a ceramic plant consumes nearly one per cent of the total LPG consumption in Hong Kong.

One small sub-section under this category is the agricultural accounts. Small amount of LPG is used in poultry farms during cold seasons to warm up the poultry houses.

(4) Commercial users: Most of these are restaurant and food stalls using LPG for cooking. They are similar to the industrial users in many aspects. Large discounts are usually granted, depending on their volume. Like industrial users, they often enter into a supply agreement with the oil company for a period of three to five years.

(5) Government: Government consumes around 1.5% of the total LPG volume in Hong Kong. Supplies to various government departments and the Army are secured through tenders. Over the years the Government has invariably adopted the policy of awarding the supply contract to the lowest bidder though she is not obliged to do so.

The volume of each of the operating companies in 1984 is listed

below against the number of domestic outlets and number of authorised distributors:

Company	A	B	C	D	E
1984 Volume (kL)	64,915	44,629	73,030	129,830	93,316
BULK					
No. of Bulk Dom. Outlets	9	3	17	15	24
Bulk Dom. Volume	9,088	4,017	18,257	9,088	18,663
% of Total Volume (%)	14	9	25	7	20
Ind./Comm. Bulk	3,895	2,231	7,303	9,088	3,733
% of Total Volume (%)	6	5	10	7	4
PACKED [1]					
No. of Distributors	150	90	75	120	130
Vol. thru Distributors	51,932	38,381	47,470	111,654	70,920
% of Total Volume (%)	80	86	65	86	76

Source: LPG Department, Company D
All figures have been disguised.

Note:
1. Packed volume includes industrial packed offtakes, which are delivered through distributors.
2. Government volumes are not shown separately; they are included in Packed or Ind/Com Bulk depending on the mode of delivery.

It can be seen from the above figures that all oil companies derive a large proportion of their volumes from the packed business. In the bulk sector the emphasis is on the bulk domestic sector for all the companies. There is no sign of focus on any particular sector by the companies. It follows that all the companies are adopting an undifferentiated approach in the customer group dimension.

Customer Functions

We can broadly divide LPG applications into two groups: domestic use and industrial/commercial use. Domestic users use LPG in cooking and water heating. It has been proposed that LPG be used in refrigeration and air conditioning in Hong Kong, but the idea was not pursued due to heavy capital expenses involved in promoting these applications and in installing the equipment. LPG sold through distributors, which account for over 80% of the total volume, is mainly for domestic use. This is also the major market segment for all the operating companies in Hong Kong, as seen from the above figures.

The balance of LPG is sold to industrial and commercial customers for various applications. The fact that large discounts are granted to these customers reflects two concerns: the keen competition amongst the oil companies and the equal ability of each company in serving the customers. It reveals that the companies are not concentrating in serving a particular customer function. This can partly be explained by the nature of the product which has no significant difference in fulfilling the needs of the end users.

Technology

All the five operating companies derived their technical know-how from their group companies operating world-wide. There are slight differences in their equipment offered to their customers (e.g. cylinder regulators have different configurations and connections). However, the differences serve to prevent the customers from switching from one to another (due to non-interchangeability of the equipment) rather than designed to meet the different needs of the customers. As far as operational requirements are concerned, the five oil companies tend to converge to a universal set of specifications pertinent to the product

properties.

Each of the five oil companies has their oil depots with cylinder filling facilities. Cylinders after filled are dispatched to the end users by distributors. The mode of operation is the same for each company. Differences are detected in the efficiency of service, which distinguishes one distributor from another rather than the oil companies. One can argue that the management of the oil company will directly determine the services offered by their distributors. No research so far has shown the reasons for housewives to choose one brand of LPG against another. From our observations it could be a matter of convenience-- people choose the most near-by distributor, whether they are Company A, Company B or Company C. The locations of the distributors are major strategic decisions for the oil companies.

As for the bulk supplies, more technical know-how is involved. Over the years, the oil companies have acquired nearly all the experiences required in serving local customers. Recently the Government is urging the industry to formulate a code of practice for the installation of bulk systems as the basis of self-regulation for the industry in lieu of legislationary control. As a result the five oil companies jointly employ a consultant from Canada to work on a standard manual. This further draws the knowledge and experiences of the oil companies together and as far as how the end customers are served, the difference in technical know-how is very much minimized.

From the above account it is clear that all the oil companies in Hong Kong have identical definitions along the three dimensions in the LPG business and they all follow an undifferentiated approach in their business. So far no major deviations from this has been

observed in the way business is conducted in the SEZs. We can be quite safe to assume that the same is true for the SEZs market.

It follows from the preceding discussion that in the LPG industry the market boundaries are completely overlapping with each other. The complications due to partial overlapping of the market boundaries had the oil companies defined their business in different ways will not arise. We can thus analyse the LPG industry using the 'total market'. This inference is very crucial in our subsequent discussions about cost-experience effect and the meausure of profitability in which the market has to be well defined.

Before moving on to the next topic it is worthwhile to mention that in some industries there is a fourth dimension in the business definition-- the value-added system (Day 1981). Products or services move through complex stages during the transformation from raw material to an end project; during each stage value is added to the product. Competitors may choose to operate at one level of the production-distribution process, or they may integrate either backward or forward into two or more levels. When competitors are operating on a number of different levels, the question of whether to treat the levels separately or combined will arise. In the LPG industry in Hong Kong and SEZs, each of the major oil companies is operating as a local marketing company though they are linked to their parent companies (which operate refinery and distribution facilities worldwide). These local market companies secure their supplies from various sources, store the product in their own depots and distribute to the end-users by their own means. In other words, they are operating as individual profit centres. The fourth dimension is thus not significant in comparing their operations.

Competitive Marketing

In a competitive marketing environment, each company aims at positioning his business to maximise the value of his capabilities and distinguish from his competitors (Porter 1980). Whether explicitly or implicitly, each company is following his own marketing strategies in the pursuit of competitive advantage over his rivals. The profit potentials of individual firms depend on a number of factors:

1) The common characteristics of the industry

The common characteristics of the industry will determine the overall profit of all the companies. This in turn is determined by many factors; product cycle being one of them. A product may be at its introductory, growth, mature or decline stage. During the early stages, the industry is growing and every participant will experience high growth. Many new entrants come in to compete. This is the case in the initial years when LPG was introduced into Hong Kong in 1962. The same can be observed in SEZs. When the product has reached its decline stage, the total market is contracting, and competitors may be forced to withdraw from the market.

The long term change in growth of an industry is also affected by other factors. Demographic change has great impact on the total demand. With economic conditions improved, people enjoy higher salaries and the effect of income elasticity can be significant. In the past when the income level was low, people were used to conventional fuels like coal or wood. When the living condition is improved and people get more earnings, they are more willing to spend on the more expensive but more convenient and cleaner fuel like LPG. The trend of the need will gradually change. The relative position of substitutes is

an indication of the growth of an industry. Coal and LPG are substitutes of one another as the domestic fuel. Price and availability affect their relative positions and growth prospects. The ability of the supplier to penetrate the customer group is yet another factor. The demand for LPG could be large in villages, but the supply may be limited by access problem. Some potential customers may have preference over substitutes because of some deep-rooted belief (e.g. safety, easy handling). Complementary products also affect the growth. LPG as a fuel is used with some appliances like LPG stoves, LPG water heaters etc. Are these appliances readily available ? Are the prices acceptable by the end-users ? Complementary products affect the industry as a whole, so are local regulations. The government policy may preclude or limit the use of a particular product; or may control the propaganda of that product, like the banning of cigarette advertisements in some countries.

LPG is on the lighter end of the barrel and is a 'preferred' product by the oil companies for its relatively higher margin than other products. In other words, oil companies are willing to inject capital investments into this sector, thus improving the efficiency in LPG marketing and raising its earning potentials.

(2) Characteristics of the strategic groups

Strategic group is the aggregate of all companies pursuing similar strategies. Within an industry there may be many strategic groups.

The profit potential of an individual firm depends on the characteristics of the strategic group it belongs. Strategic

groups are characterised by their mobility barrier (the ability of the group to shift its position), the bargaining power (as a group), vulnerability to substitute products, and rivalry from other strategic groups.

The LPG business is supported by heavy commitments in capital investments in setting up the depots, storage compounds, tanker receiving facilities, distribution network and the associated logistics. Entry barrier is extremely high. This partly explains why there are only five LPG marketers in Hong Kong. The heavy commitments also impose a high mobility barrier on the oil companies. This differs substantially from LPG's substitutes like kerosine.

(3) Position within the strategic group

The position of the firm within the strategic group will determine its earning potentials in relation to its competitors. The relative position is determined by the degree of competition and the strategy of the firm. This leads to the development of competitive strategies, the discussion of which follows.

Competitive Strategies

In order to gain competitive advantages over competitors, a firm must formulate its own strategies appropriate to the market in which it is operating. Porter (1980) remarks that the formulation of competitive strategies will call for:

(1) an analysis of the industry to identify the key factors of competitive forces;

(2) competitors analysis to identify the capabilities and limitations of the competitors;

(3) a study of the external factors, e.g. social and political factors;

(4) an analysis of own firm's strength and weakness;

(5) an evaluation of the current strategy, either explicit or implicit and a study of alternative strategies.

Porter then proposes that there are three generic strategies:

(1) Overall cost leadership

If a firm can achieve and sustain overall cost leadership then it will have an above average performance in industry provided it can command prices at or near the industry average (Porter 1985). Its low cost position will enable it to enjoy a higher margin than its competitors. This will be true regardless of general fluctuations in economic conditions and indeed the lower cost competitor should enjoy both superior and more stable profitability (Hedley 1976). An adverse change in economic conditions resulting in an overall lower price throughout the industry will make the margin of a higher cost firm drop proportionally more than the lower cost competitor. To achieve a low cost position a firm will invariably be involved in the construction of efficient-scale facilities and engaged in tight control of cost. Heavy capital investment in automation and scale production as a means to reduce unit running cost is common. On the marketing side, aggressive pricing policy may be used.

This approach is not one that can be applied without risks. Should there be major technological changes in the product or the means of production, it will be very costly for the lower cost competitor who has heavily commited in obsolete machinery and equipment to shift to new and more efficient methods. His cost superiority will be lost. Sometimes a firm pays great attention to cost reduction and unable to see the

required change in product and market. The need of the customer may change, and the firm may find himself building up too much inertia to change accordingly.

(2) Differentiation

A firm may differentiate himself from his competitors by offering differentiated products/services, design, brand image, technology, features, dealer network and so on.

By differentiation, a firm can create a defensible position to cope with the five forces of buyer, supplier, potential entrants, substitutes, and industry competitors. A strategy of differentiation may preclude a high market share, but will generally enjoy a higher than average selling price from his customers who are willing to pay premium for the differentiated features.

There are potential risks in this strategy when the customers' need for differentiation falls. Or, imitation by competitors will minimize the differentiation. The level of price has to be carefully adjusted to avoid customers' perceiving that the cost differential is not in proportion to the additional benefits gained from the differentiated product.

(3) Focus

Focus can take on two variants: cost focus or differentiation focus. It aims at focusing on a particular customer group, or a particular segment of product line, or a particular geographical market. It has a narrow strategic target to serve, and if carefully monitored, it can serve the particular target more effectively and more efficiently than other firms serving a broader target due to its tailer-made approach. The customer will feel that they are better served

because their needs are satisfied in finer tones.

Risks in this approach arise from a widening cost differential that defers the customer to pay for the differentiation achieved by focus. It may also arise from competitors finding submarket within the strategic target and outfocusing the focuser.

Strategies Employed by LPG Marketers in Hong Kong

Our previous discussion shows that the LPG marketers in Hong Kong and in SEZs are adopting a common definition of their business: broad scope and undifferentiated along the dimensions of customer gorups, customer functions and technologies. The fact that the marketers are arriving at the same definition cannot be simply explained by coincidence. There could be some underlying marketing forces that have directed the oil companies to go on the same route. Day (1984) quotes the finding of Strategic Planning Associates "two factors within an industry will significantly constrain the choice of generic strategy. The first factor is customer price sensitvitiy, ranging from high- because the product is expensive or is a large element of their budget- to low- meaning the product is inexpensive or a small item in the budget. The second factor is the customer's perceived differentiation among products in the market--the extent to which a significant difference is present between competitors' products; a difference they are willing to pay for."

These two factors will determine the appropriate strategy to follow. The relationship is shown on the next page.

It can be seen that for a firm to adopt the strategies of differentiation or focus, the product it offers should be perceived as different from those offered by its competitors. Our previous discussion about the LPG market shows that although there is

Customer Price Sensitivity			
	High	OVERALL COST LEADERSHIP	DIFFERENTIATION
	Low	(HYBRID)	FOCUS
		Small	Large

Perceived Relative Differences in Product Offerings

difference in product offerings, in packing sizes, services delivered and etc., such differences do not justify any premium price. The need of the customer can equally be well satisfied by using LPG sold by any other company, as the product itself is almost identical. It happens in the depots that if an oil company is short of LPG it will borrow it from other oil companies by offering some handling charges.

The chance of success if an oil company follows a differentiation or focus strategy in the LPG market is thus ruled out.

For products with extremely low perceivable differences like LPG the customers naturally look at the price very critically. We recall that in the discussion of the customer groups there are five major categories of customers. Except in the domestic packed sector in which a unified list price prevails and thus appears to have no relevance to the issue of price sensitiviy, all the other sectors are extremely price elasitc. Supply contracts are secured either through bidding or negotiation. The discount level ranges from 5% up to more than 30% off the list price depending on the volume, period of contract and equipment terms.

Even in the domestic packed sector, price mechanism is also functioning silently. Nearly all the packed sales are distributed through agents, who purchase the product from the oil companies and then re-sell it to the end users at fixed list price. Viewing from another angle the agents are the immediate customers of the oil companies. The selling term offered to the agents varies from one company to another, and is composed of many elements: rebates, commissions, incentives, cylinder rentals, deposits, ex-depot price, allowances and etc. In some cases the agents are bound by contracts to serve a particular oil company. The attractiveness of the selling term is a determining factor of how much effort these agents will put in promoting the sales. In case the agents are no more bound by contracts, it is not uncommon for them to shift from one oil company to another.

We can thus conclude that the LPG market is high in customer price sensitivity and low in perceived relative differences in product offerings. The only appropriate strategy for the oil companies to follow is thus overall cost leadership. When all oil companies define their business in the same way, the relative success will depend on the relative effectiveness and efficiency in implementing this strategy.

In the next section we will discuss how overall cost leadership is achieved in many other industries.

Experience Effect

Wright (1936) in his study of the number of labour hours required to produce an aeroplane has made an important observation: the labour hours required decreased systematically at a uniform rate with the cumulative number of aeroplanes built. What has been

hinted is: increased experience will lower the unit cost of production. This observation is a great step forward in our understanding of how overall cost leadership can be achieved. It was noted by Abell (1979) "subsequent researches by Boston Consultant Group and many others showed that each time cumulative volume of a product doubled, total value-added costs-- including administration, sales, marketing, distribution etc. in addition to manufacturing-- fell by a constant and predictable percentage. The relationship between costs and experience was called the experience curve, also known as the learning curve."

Evidence in experience curve effects can be found in the studies of Boston Consulting Group (Day and Montgomery 1983). They have plotted thousands of experience curves and these analyses have ranged from the direct costs of US long distance calls, integrated circuits and life insurance policies, to the prices of bottle caps in Germany, refrigerators in Britain, polystyrene molding resin in the States and motorcycles in Japan.

Further evidence can be found in the study conducted by Lieberman (Day and Montgomery 1983) in which the prices of 37 products in the chemical processing industries were analysed over a period of one year to three years. The results showed that cumulative experience was very significant, with a coefficient corresponding to a 72% slope. (The meaning of slope will be discussed later.)

Using the Boston Consultant Group file case, Wooley obtained cost data for 18 products from 10 companies and his analysis showed strong support for the experience curve effect (Day and Montgomery 1983). The median experience slope in his sample was 77.5% with over 75% of the slopes of 70 and 90%, which is the usual range

suggested by BCG based upon their client studies.

Some of the experience curves based on the BCG study and quoted by Abell (1979) showed that the two dimensions used to describe the experience curve effect, namely cost and cumulative experience, could assume many forms. Some of the examples along the cost dimension are: direct cost per unit energy generated, average unit price, and average quoted price per pound. Examples along the cumulative experience are: cumulative number of pounds of material produced, cumulative units of energy generated, and cumulative hours of direct labour. Cautions have been exercised that it is the cumulative experience that one should account for, not the cumulative time over which experience accumulates. In other words, if a firm produces twice the usual volume in a particular year, then his experience will double for that year. The basic concept of experience curve precludes the use of time scale as the measuring stake unless it can be shown that the volume of production is the same over each of the time periods under consideration. This is rarely the case in a growing industry; in which experience is accumulated much faster in the earlier years when the growth rate is high and is declining over the years when the industry gradually matures. Also, it becomes more and more difficult to double the previously accumulated experience as the company has accumulated more and more experience.

On the cost dimension it has been shown that the experience curve effect holds for either direct cost or overall total cost, though it must be remembered that if total cost is used the different cost components may each follow a different experience slope, thus the resultant experience slope shows a combined effect.

Another important point is the unit of the cost. In the BCG

studies, only the real cost (after inflation effect is removed) is considered. The choice of deflator depends very much on the nature of the cost incurred. If a large proportion of the production cost is due to direct labour, then a good index would probably be one reflecting the increase in general wages over the period of the study.

The experience curve can be expressed as:

$$C_N = C_0 N^i$$

where Y_N = cost of the N^{th} unit

C_0 = cost of the first unit

N = cumulative number of units produced

i = log k/ log 2 = learning index

k = learning rate = 2^i

1-k= progress rate

If k= 0.75, then cost will fall by 1-0.75= 25% as experience doubles, and the experience curve is said to be a 75% curve, or has a 75% slope.

Sources of Experience Curve Effect

There are three major sources (Day and Montgomery 1983): learning by doing, technological advances and scale effects.

Learning effect is the result of increasing efficiency of all aspects of labour input due to practice and the exercise of ingenuity, skill and increased dexterity in repetitive activities. The output of equipment is increased because operatives using the equipment are more familiar with them; and because maintenance becomes more efficient. A survey of 13,000 new products in 700

companies by Booz, Allen and Hamilton in 1981 found that the cost of introduction of new products declined along a 71% slope.

Technological advances especially in capital intensive industries often contribute substantial economies. Product standardisation and redesign are also sources of the effect.

Economies of scale is another source of the effect. Large scale production creates potentials for volume discounts and division of labour, which in turn facilitates learning. Full use of plant and delivery capacity and increased efficiency due to scale also contribute to the effect.

Cross-sectional Experience Curves

Henderson noted that cross-sectional experience curves were those that relate the relative cost positions of the competitors in an industry (Day and Montgomery 1983). With this curve we can estimate the profitability of the competitors given their cumulative experience which could be available in published data. While it is potentially the most useful experience curve, it is not easy to construct. A company usually knows the slope of his own cost curve, but it cannot readily be assumed that the competitors follow the same curve. Some researches in the 1970's showed that the cross-section curve is shallower. There are many reasons for it:

(1) Competitors may not start at the same time. They may have an opportunity to learn from the pioneers' mistakes.

(2) A follower may leapfrog the pioneer by using more advanced technology while the pioneer is stuck with old designs.

(3) All competitors should benefit from the experience of their common supplier of raw material or components.

(4) There may be some other factors that cannot be accounted for by experience, e.g. government subsidy.

(5) Competitors may have different overhead allocation depending on whether they are stand-alone businesses or divisions of a large company.

It could be more justifiable to apply one's own curve to other competitors if the above factors are not significant. Similar method has been proposed by Boston Consulting Group and P. Conley in 1970 (Yelle 1979) to use a version of the experience curve to assess competitor's manufacturing costs and to compare the data with internal data to generate decisions of a marketing strategy nature.

Limitations of Experience Curve

One of the limitations of experience curves lies in the fact that costs can be further broken down into many components, and each component may follow a different slope. Some of these costs are controllable while other may be determined by outside factors. For example, inclusion of raw materials costs may mask the desired effect (Day and Montgomery 1983). The choice of deflator to compare the costs on real terms poses another problem that has to be dealt with carefully.

The frequency with which the cost reduction over cumulative volume is found in practice sometimes leads to the incorrect impression that the experience curve effect just happens. On the contrary, product design, marketing, purchasing, engineering and manufacturing have to be carefully coordinated and managed (Abernathy and Wayne 1974). Management failing to recognise this will experience the reverse effect of increased unit cost by expanding unwisely.

The experience curve is sometimes followed without analysing the market situation in detail. When the market is more concerned with product and service features and up-to-date technology, a

company pursuing efficiency can find itself offering a low-priced product that few customers want (Abell 1980). The consequence of intensively pursuing a cost minimization strategy may lead to a reduced ability to make innovative changes and to respond to those introduced by competitors. The problem of choice of strategy has to be balancing on the hoped-for advantages from varying degrees of cost reduction against a consequent loss in flexibility and ability to innovate (Abernathy and Wayne 1974).

Implications of Experience Curve

According to the Boston Consulting Group (Hedley 1976), the basic strategic message of the experience curve is:

(1) The largest competitor in a particular business area should have the potential for the lowest unit cost and hence the greatest profit.

(2) Smaller competitors in a business area are likely to be unprofitable, and they will remain so unless a strategy can be devised from gaining dominant market share at reasonable cost.

The conclusion echoes the finding of PIMS (details of which to be discussed in the next section) in which it was shown one of the main determinants of business profitability is market share. The PIMS study observes the correlation between profitability and market share; while the Boston Consulting Group approach from the other side and establish the relationship of cost and cumulative experience, which can generally be reflected by market shares provided the share positions have not experienced major changes.

Similar conclusion was arrived at by Spence (1981), who noted that the learning curve created entry barriers and protection from competition by conferring cost advantages on early entrants and those who achieve large market shares.

Profit Impact of Marketing Strategy

The bottom line in any evaluation of marketing strategy is an assessment criterion for the effectiveness of the strategy. A commonly used criterion is the profitability. In an attempt to study the profit impact of marketing strategies (PIMS), the Marketing Science Institute undertook an ongoing study aiming at providing corporate top management, divisional management, marketing executives, and corporate planners insights and information on expected profit performance of different kinds of businesses under different kinds of competitive conditions (Buzzell, Heany and Schoeffler 1974). Among the 37 factors investigated and analyzed were market share, total marketing expenditures, product quality, R&D expenditures, investiment intensity, and so on. These factors accounted for more than 80% of the variation in profit in the more than 600 business units analyzed. The return on investment (ROI) is the parameter adopted to indicate the profit level and relative success of the businesses.

In particular, a few questions that have been addressed are:

What rate of ROI is normal in a given type of business, under given market and industry conditions ?

What factors explain differences in typical levels of ROI among various kinds of business ?

How will ROI in a specific business be affected by a change in the strategy employed ? By a change in competitive activity ?

In Phase One of PIMS, 36 corporations supplied information on some 350 businesses. The information included descriptions of industry and market characteristics, as well as selected operating results and balance sheet figures for the years 1970 to 1971.

The analysis of PIMS gives strong support to the proposition

that market share is a major influence on profitability. It was found that on the average a difference of ten percentage points in market share is accompanied by a difference of about five percentage points in pretax return on investment. On the average, businesses with market share above 36% earned more than three times as much, relative to investment, as businesses with less than 7% share of their respective markets. The findings also suggest that businesses with relatively large market shares tend to have above-average rate of investment turnover. The ratio of marketing expense to sales is generally lower for high-share businesses than for those with small market shares. The data indicate that larger companies derive greater advantages from strong market positions than smaller companies do, reflecting the ability of larger companies to provide adequate support for strong positions, in terms of management personnel and funds for marketing or R&D.

It was suggested (Buzzell, Gale and Sultan 1975) that under most circumstances, enterprises that have achieved a high share of the markets they serve are considerably more profitable than their smaller-share rivals. Phase Two of the PIMS project, completed in late 1973, reveals 37 key profit influences of ROI, of which one of the most important is market share. The study again shows that on the average, a difference of 10 percentage points in market share is accompanied by a difference of about 5 points in pretax ROI.

Because market share is so strongly related to profitability, Buzzell suggests that a basic strategic issue for top management is to establish market share objectives. In another article by Buzzell (1981), he points out that the distribution of the market shares follows a common pattern of a skewed distribution. The average leading competitor's market share was 32.7%, average share for the

second, third and fourth largest competitors were 18.8%, 11.6% and 6.9% respectively. Why market share distribution should follow a skewed pattern approximated by a semi-logarithmic distribution is unknown; but the findings are suggesting that there are natural structures in the market share distribution. In establishing the market share objectives this point should be noted.

Not totally agreeing with the above findings, Bloom and Kotler (1975) challenged the PIMS study in that it does not reveal whether profitability eventually turns down at very high market-share levels. They claim that the study lumps together all market share above 40%; and therefore, the behaviour of ROI in response to still higher market shares is undisclosed. The profitability could drop dramatically if share further increases for the following reasons:

(1) Holdout customers may be loyal to competitors, so the cost of attracting them might exceed their value as new customers.

(2) The needs of these customers may be unique and not worth the cost of catering to.

(3) Companies seeking to enlarge their share of market may have to carry extra costs of legal work, public relations, and lobbying to defend their larger market share against criticism and regulation.

They suggest that a company should optimize the market share rather than maximizing it by i) estimating the relationship between market share and profitability; ii) estimating the amount of risk associated with each share level.

Possible Explanations

With reservation on shares above 40%, three possible explanations for the strong association between market share and ROI are (Buzzell, Gale and Sultan 1975):

(1) Market power

The high share companies are able to bargain more effectively, administer prices and realize significantly higher prices for a particular product due to their sizes.

(2) Quality management

Both share and ROI reflect a common underlying factor of quality management. Good managements succeed in achieving high shares in their respective market; they are also skillful in controlling costs, getting maximum productivity from their employees and so on.

(3) Economies of scale

High share companies achieve economies of scale in procurement, manufacturing, marketing and other cost components. This is closely related to the 'experience curve' effect widely publicized by the Boston Consulting Group.

Market Share Strategies

Whether the market-share goals are feasible depends on the strength of competitors, the resources available to support a strategy and the willingness of management to forgo present earnings for future results (Buzzell, Gale and Sultan 1974). There are three broad strategies :

(1) Building strategies-- The company attempts to increase share by added marketing programm, new product introduction and so on. There are several considerations in share building (Bloom and Kotler 1975): whether (a) the primary market is growing, stable, or declining; (b) the product is homogeneous or differentiable; (c) the company's resources are high or low in relation to competitors' resources; and (d) there are one or several competitors and how effective they are. For most

markets there is a minimum share that is required for viability. Generally speaking, businesses that are building share pay a short-term penalty for doing so. PIMS data show that the ROI can be 1 or 2 percentage points lower than those that maintained more or less steady positions.

(2) Holding strategies-- the company puts efforts to maintain the share by (a) a good defense as a result of product innovation, renewed channels of distribution and so on; (b) market fortification to plug market holes to prevent competitors from moving in (A company may introduce a number of brands competing with each other to tie up scarce distribution space and lock out some of the competition); and (c) confrontation strategy by initiating expensive promotional or price-cutting wars to discipline upstart competitors. PIMS data show that ROI is usually greater for large-share firms when they spend more than their major competitors in relation to sales on sales force effort, advertising and promotion, and research and development. The reverse is true for low-share companies where ROI is highest for companies spending relatively fewer dollars on marketing and R&D.

(3) Harvesting strategies-- The company aims at achieving high short-term earnings and cash flow by permitting the share to decline. Harvesting is often a matter of necessity than of strategic choice. For example when the firm is urgently in need of cash to finance other projects. It is shown by the PIMS data than only large-share companies can in general harvest successfully.

Summary

In this chapter we aim at building the theoretical framework for

subsequent discussions. From previous literatures we succeed in establishing an appropriate framework to analyse the marketing competition of LPG in SEZs. We summarise below what we have discussed, and we put up two postulations that can be verified by collecting and analysing the data related to the LPG market in Hong Kong.

(1) We conclude that different oil companies in Hong Kong and SEZs have a common definition of the LPG market. We can study the marketing competition of the LPG industry by analysing the total market.

(2) We establish that overall cost leadership is the only appropriate strategy that LPG marketers should follow.

(3) We note that experience curve effect was observed in many industries. The experience effect is the root of the overall cost leadership strategy. We postulate that experience curve effect holds in the LPG industry.

(4) We note that market share has been observed to be the single major determining factor of profitability in many industries. We postulate that profitability is directly related to market share in the LPG industry.

Specifically, there are two hypotheses in this study:

H_1 : Experience curve effect holds in the LPG industry.

H_2 : Profitability is directly related to market share in the LPG industry.

This concludes our section on literature review. Subsequent chapters in this report will concentrate on the verification of the two hypotheses put forward and the marketing implications so derived. In the next chapter the methodology employed in this research will first be discussed.

CHAPTER III

METHODOLOGY

Experience curve effect has been identified in many industries. This research will utilise the concept embedded in the experience curve effect to examine one single industry-- the LPG industry. LPG was introduced into Hong Kong about twenty-five years ago; and a series of data has been accumulated over the past years to enable us to examine to what extent experience curve effect is applicable. It has been postulated that market share is the predominant factor in determining profitability. This aspect will be examined using the Hong Kong data to verify whether the statement holds for the LPG industry in Hong Kong.

Hong Kong as an Analog

As mentioned in the first chapter, we will use the results derived from the Hong Kong data to project the market competition situation in the Special Economic Zones in China. Why the projection is significant has been discussed, and the justifications for using Hong Kong as an analog has also been clarified. Two of the considerations are repeated here: First, SEZs were set up in 1979, and most of the developments commenced in the last two or three years. The market of LPG is completely new to the foreign oil companies, and the same is true for their business partners in China. LPG has been known to the Chinese for some time, but the shortage in supply and relatively higher price have been deterring people from using it widely. Very few market data can thus be gathered; those available are not refined enough to reveal the

underlying factors for further analysis. Secondly, SEZs are very similar to Hong Kong in many economic aspects, partly because SEZs are established based on the model of Hong Kong, and partly because many Hong Kong people are involved in the economic activities in SEZs bringing with them their way of thinking and modes of conducting business.

The significance of using Hong Kong as an analog lies in its predicting power. We recall that the same oil companies who have competed for the LPG market in Hong Kong for over twenty years now compete in the SEZs in China. They are facing a maturing market in Hong Kong; annual growth rate is below five per cent. This is one of the drives that leads them to look into a potentially much bigger market-- China. The question of how to compete in this hitherto unknown market is in the mind of all the marketers. It is clear that an analysis and a conclusion of their experience in Hong Kong will help them understand the underlying factors affecting their future performance in SEZs. This understanding is crucial to their strategy formulation.

In the following discussion we are referring to Hong Kong data wherever not specified, keeping in mind that the implications drawn from these data will be applicable to SEZs in China.

Experience Curve

We have postulated in the last chapter that experience curve effect would also be observed in the LPG industry. In order to verify this hypothsis empirically, we will first define the variables in the experience curve formula and then describe how empirical data are collected.

There are two parameters in the experience curve formula that we have to define: cost and experience. We will first of all examine

the cost structure in the LPG business and derive from it the definition of cost in our empirical verification. The definition of experience will follow in the next section.

Cost Elements

In the LPG market in Hong Kong, we can identify the following cost elements:

(1) Product cost

Each oil company has its own sources of LPG. The price of imported LPG varies in accordance with the world supply and demand situation by and large, with some variations in local supply scenario and also the contractual relationship between the supplier and the buyer. Some oil companies are associated with refineries in South-East Asia because they belong to the same group, e.g. Mobil and Shell have refinery facilities in Singapore. Though oil companies within the same group usually operate as independent profit centres and are free to purchase from whatever sources they can secure, there are times when companies in the same group will give concession to sister companies if the interest of the whole group is affected. This could result in different levels of product cost within the LPG market in Hong Kong.

The product cost cannot, however, differentiate itself once the product is pumped into the depot. To summarise, different oil companies may have different product costs, but within the same oil company the product costs for the two market segments of bulk and packed business are identical. The costs will vary over time, but changes are simultaneous for the two market segments within the same company.

(2) Storage and handling costs

These refer to the costs associated with the capital charges for the storage tanks and accessories, maintenance costs of the storage facilities, working capital of the LPG stock, time charge for the unloading facilities when LPG vessels unload their goods, etc.

Again, the cost is charged on a unit volume basis disregarding the subsequent treatments to the product.

(3) Operation costs

These refer to costs associated with the process of physically delivering the product from the depot to the end user. For bulk deliveries the capital charges for bulk lorries and loading facilities, maintenance of these facilities, labour costs for operating the facilities, wages of drivers and lorry mates, and appropriated cost for maintaining the LPG plant are included. For packed deliveries, typical cost items include refilling charges, capital charges for the refilling carousel and LPG cylinders, handling charges for the spare cylinders and so on.

The costs for the two market segments, bulk and packed, could in theory be separated. It is also likely that they follow different experience slopes.

(4) Operation overheads

This is an appropriated cost to account for the expenditure incurred for the operation of the whole depot which handles quite a number of different petroleum products besides LPG. The appropriation is purely a managerial decision, but the usual practice is to divide the total cost by the total volume of all products to arrive at an average unit cost applicable to all products alike.

(5) Direct selling cost

It is associated with the traceable costs related to the sales to a particular market segment. Thus bulk sales have their own direct selling cost, and the same is true for packed sales. The cost includes items like rental charges for showrooms (associated with packed sales only), charges for free services provided to bulk customers, advertisements and so on.

(6) Company overheads

The appropriation is a managerial decision. It includes all the other costs not accounted for, e.g. expenditures incurred by supporting department like finance and personnel, office rentals, general advertisements, etc.

Cost groups

To ease our discussions, I have divided the above cost elements into three cost groups:

Cost Element	Cost Group
Product cost	Product cost
Operation costs	LPG direct cost
Direct Selling costs	" " "
Storage and handling costs	Overheads
Operation overheads	" " "
Company overheads	" " "

Product Cost

The cost fluctuates with the worldwide changes in supply and demand situations, and it also reflects the ability of the company to negotiate better terms with the suppliers. All the oil companies are trading in a number of petroleum products; they are also associated

with some refineries of the same group. An oil company with a large overall volume should be in a better position to negotiate better terms. In the average oil companies LPG is in the high margin sector and the volume is small compared with other petroleum products (less than 5 % in total volume but generates a gross margin of over 15 % for one of the oil companies in 1980). Thus the unit cost of LPG is more affected by other factors than by the volume of LPG itself. In view of this very nature I have excluded the product cost in the cost analysis.

LPG direct costs

They refer to those costs (excluding product cost) that can be traced to be incurred by the LPG business alone but may not be identifiable to any sector within the LPG business. For example, LPG plant cost includes the operating cost of the filling plant (to both bulk lorries and to the cylinders). It is totally incurred by the LPG business but one can hardly trace the proportion of cost incurred by bulk or by packed. Some appropriation is required. By considering the total LPG plant cost we can avoid the subjective element in appropriating the cost to the two sectors. Expenses of the LPG marketing department are also counted as LPG direct costs. Again, one can hardly trace the proportion of expenses of the LPG department to the sectors, though a company may have a department divided into two distinct sections of bulk and packed. There will invariably be many crossed activities between the two sections, and any appropriation will not be complete without taking into consideration of the cross-flow of resources. Some companies use the time-allocation as the basis for appropriation. Staff in bulk section spending 20 % of his time in the packed section would charge this amount to the packed section accounts. More often this is a

means to play around with the bottom line profitability of each section rather than truly reflects the resources employed in each section.

LPG direct costs are directly related to the LPG business. The magnitude of spending is affected by the product being handled, in this case LPG, the personnel handling it, the way it is handled and the amount of product handled. These costs are the ideal candidates for the study of experience curve effects.

Overheads

In order to avoid confusions the word itself needs some clarification. I use overheads here to include all the costs which by its nature are incurred due to more than one petroleum product sharing the resources. One example is the handling costs in unloading the products from the tanker to the depot storage tanks. This cost element can be further broken down to the maintenance cost of the receiving facilities including the pier for the berthing of tankers and such equipment like flexible hoses used to connect the tanker to the receiving pipelines on shore, and the labour cost of operatives engaging in the receiving activities. It is theoretically possible to trace the number of labour hours engaged in receiving LPG tankers as compared with tankers with other products. It is also possible to trace the maintenance cost for the equipment and allocate it to a particular product. The fact that LPG equipment is very different from other products (many light oils use a common receiving line, but LPG has its own receiving line) can even make it easier to trace back. In practice this is never done, possibly because the enormous efforts required are not justified by the benefit of precise allocation of cost. The common practice is to divide the total cost incurred by the total volume of all products

using the facilities to arrive at a unit cost, which will be applied to all products in a uniform way.

Another example of overheads is the cost incurred by supporting departments like finance and personnel. Each company has its own convention in allocating the costs to each of the many products. Some base on volume, and others base on gross margin. It is common to have several hierarchies of allocation: Cost incurred by personnel department is allocated to the marketing, finance and other departments first. The finance department costs after absorbing his portion of the personnel overheads will then be allocated to the other departments including marketing. The loop is closed when marketing department allocates its cost after absorbing all other overheads to the different products on some pre-established basis.

We can see that overheads cannot directly be applied to the product without any appropriation process. Very often the process is volume-driven. The unit cost depends on the performance of the whole company in handling sales of all its products. It is not in particular effective in analysing the LPG business unless some correction terms are introduced to nullify the volume effect of other products.

In summary the LPG direct costs as defined above will be most effective in examining the behaviour of cost with its associated cumulative experience. The result of the analysis will have more significant managerial implications in that it highlights the cost patterns that are solely related with the LPG business and thus can be modified by changing the mode of activity in the LPG business only.

Collection of Cost Data

The cost data of one of the oil companies (Company D) over the last five years form 1981 to 1985 were collected and analysed. The accounting system of the company is such that each cash outlay must be recorded in a cost centre which further breaks down into some forty cost items; e.g. operative wages, equipment maintainence, consumerables and so on. The cost centre normally covers a large portion of the expenses incurred by the department to which the cost centre is allocated. There are exceptions in which a department is constantly spending budgets of others' cost centres. However, the amounts are small and negligible.

The cost centres were screened and those identified to be within the group of LPG direct costs were selected and summated year by year. The annual sum was then divided by the amount of experience accumulated in that year to arrive at the unit cost. The measuring unit of experience will be discussed in the following section while the analysis of the findings will be shown in the next chapter.

It is important that we are comparing the like with the like. One dollar in 1986 is not the same as one dollar in 1980 due to inflation.

The effect of inflation is removed by applying an inflation factor to measure all costs in money of 1980. The Hong Kong 1979/80-based Consumer Price Indices are widely used as indicators of inflation. In this study we will use the Consumer Price Index (A), the weights for which are derived from the expenditure pattern of households with monthly expenditures between HK$1,000 to HK$3,499. Index (A) covers about 50% of the urban households.

Measuring Unit of Experience

The second parameter in the experience curve is experience. First we have to determine the measuring unit for the experience. A few considerations have to be examined. Firstly, what are the possible alternatives ? Secondly, what are the characteristics of each of these alternatives ? Thirdly, what are the criteria of our choice ? Fourthly, what are the limitations that may affect the subsequent inductions ?

In Hong Kong, LPG is imported from various sources (mainly from South-East Asia) in LPG vessels ranging from 1,000 to 1,500 metric tons of loading capacity. Almost invariably these vessels are fully loaded and the whole cargo is pumped into the storage tanks at the depots in Hong Kong. LPG is delivered to the end-users either in bulk or in packed cylinders. For the bulk customers they have a mini-storage tank or tanks ranging from fractions of one ton to more than ten tons installed on their premises. A bulk lorry of a capacity of two to ten tons will load LPG at the depot and deliver to the mini-storage tanks on regular basis. The frequency of delivery depends on several factors. The loading capacity of the bulk lorry will determine the maximum amount of LPG delivered each time, and depending on the delivery programme the drop-size at each customer may not be of full size in order to optimize the running cost. For example, a certain customer may request for urgent refilling due to unexpectedly high consumption since the last refilling; a bulk lorry on its way to another customer may thus give halt of its load to this urgent customer so that a special run is not required. It also depends on the storage capacity of the mini-storage tanks in relation to the consumption. A high consumption with a small tank installed on the premises will obviously require more frequent deliveries than

the reverse case. The location of the customer also affects the delivery programme. In areas where a cluster of customers are in the vicinity of one another, the bulk lorry may prefer 'milk-delivery', in which a full load of LPG is shared by all the customers around the area. In other words, the bulk lorry will go to the area and top-up each of the mini-storage tanks every two or three days.

There are other customers who do not have any storage tanks installed on their premises. LPG is delivered to them in small cylinders with a capacity ranging from 2 to 50 kg. In Hong Kong, the right to refill cylinders is restricted to a small number of licence holders. The majority of cylinders are thus refilled at the oil depots by the oil companies. They are then distributed to the end users through a network of authorised distributors. Every morning the distributors will bring back to the oil depot full lorries of empty cylinders and then loaded with refilled cylinders back to their own selling areas. Cylinders are delivered to the end users by manual labour. Each oil company has its own network of authorised distributors who are exclusive to the products of that oil company.

From the above account, there are a few choices among which we may select our measuring unit of experience. These are listed below for comparison:

(1) cumulative number of cylinders handled

(2) cumulative number of bulk deliveries

(3) cumulative number of customer accounts

(4) cumulative volume of LPG sold

Each of these alternatives denotes different aspects of the business; and it is not unreasonable to adopt any one of them.

Cumulative number of cylinders handled

In Hong Kong over 80 % of LPG is sold to packed customers. Though there are a number of different sizes of cylinders, two of them predominate the market. One is around 13 kg (cylinders of different companies may vary slightly in the net capacity). Another one is around 8 kg. The fact that these two sizes are popular is not a coincidence. It is the result of matching between the requirements of the customers and the ability of the oil companies in fulfilling the requirements. The majority of families in Hong Kong have very small kitchens. Cooking stoves are normally put on top of a bench around 300 mm height. The only place to accommodate one LPG cylinder is the space below the cooking bench. The 13 kg range of clinders are about the largest size that can be slotted into that space. In families with even smaller kitchens, the 8 kg range of cylinders becomes the only choice. According to the LPG distributors, a family normally consumes about two cylinders of LPG each month; so deliveries have to be made twice each month. This is acceptable to both the consumers and the distributors. Too frequent delivery will certainly not be welcome by the customer, and it will probably increase the unit operating cost of the distributors if the same amount of LPG is delivered in several runs in smaller cylinders instead of one single run. Larger cylinders will decrease the frequency of delivery, but the operatives may find it very difficult to manually deliver them to the customers. In some of the older districts in Hong Kong we can find many old buildings six or seven storey high without passenger lifts. A 13 kg cylinder weighs more than 20 kg when fully filled. Sizes larger than this would probably require some mechanical means to uplift.

The cost of packed sales has strong association with the number

of cylinders handled rather than the total volume handled. Labour cost is by and large calculated on time basis; the time required to deliver one small cylinder to the end user is very much the same as that of a larger cylinder. The same is true for returning an empty cylinder back to the store. Sales order administration cost varies with the number of orders; an order for a small cylinder or a larger cylinder will occupy the same telephone time, the same amount of stationery in recording the order, in issuing delivery orders and the subsequent invoicing (some larger distributors are using computerised systems; the expenses can be quite significant). Some even argue that smaller cylinders have raised the unit cost. Recent years have witnessed some oil companies moving towards a standard size of cylinders of the 13 kg range. The 8 kg range of cylinders is only reserved to cater for families with smaller kitchens.

The above accounts for the cost structure of packed sales after the cylinders have been delivered from the depot to the stores of the distributors. The same analysis can be applied to the pre-distributor stage. We start from the purchase of the cylinders to the subsequent cylinder filling and maintenance. LPG cylinders are not manufactured locally in Hong Kong. Most of these cylinders come from Thailand, Korea and other South-East Asia countries. The cost of one 8 kg range cylinder is about HK$120; that of one 13 kg range cylinder is about HK$150. That is, a 25% increase of cost leads to more than 60% increase in volume capacity. The purchase cost of cylinders are not in proportion to their capacities. Cylinders purchased will have to be examined and tested before they can be put into use. The cost of testing one 13 kg range cylinder is only marginally larger than that of a 8 kg range cylinder. When the cylinders are filled, they are picked by fork-lift trucks from the

storage area to the filling platform, where they are manually put to a conveyor leading to the filling carousel. Filling is done semi-automatically. A filling nozzle is placed on the cylinder filling head and tightened manually; then the trigger is pressed on. There is a weighing device that automatically stops the filling when the cylinder is full. The filling nozzle is then disconnected ready for filling another cylinder.

Routine maintenance includes inspecting cylinder by cylinder for the conditions of the valve seats, the painting, and for signs of mechanical damage. Every few years these cylinders are subjected to a detail hydaulic test to ensure that they are in sound conditions. Cylinders failing the test will be scrapped.

Though there is no detail study of the cost relationships it is reasonable to assume that the operating cost of a 13 kg range cylinder is greater than a 8 kg cylinder, but the difference is smaller than the additional volume benefit. This is especially true on the part of distributors.

It is very likely that if we are to study the experience curve effect of the distributors, we have to seriously consider using the cumulative number of cylinders as the measuring units. The same is, however, not true for oil companies. First, while we have identified that the cost for distributing the cylinders varies more with the number of cylinders than the total volume, such costs are absorbed by the distributors. LPG is sold to the distributors at a fixed cost ex-depot on the basis of volume, not on cylinders. In other words, the oil companies have the same net proceeds for one kilogramme of LPG whether it is to be sold in an 8 kg range cylinder or a 13 kg range cylinder. What will affect the cost structure is the activity inside the depot. We have examined that the cost per unit

volume in the filling and maintenance activities is potentially higher in small cylinders than in larger cylinders. A separate study on the experience effects of these two sizes of cylinders is meaningful in providing the managerial information to facilitate cost control. In our study we realise, however, that the difference in cost allocations to 8 kg and 13 kg range cylinder activities is not reported in the accounts. It is unlikely that allocations based on the existing accounts do not contain any subjective elements derived from preconceptions of how the allocations should be. On the other hand, we have to keep in mind that the filling and cylinder maintenance costs only constitute a fraction of the total operating cost. The rest of the operating cost includes a big item of storage and handling which is obviously on a volume basis rather than cylinder basis. The current practice of the oil companies in allocating overhead costs is also on volume basis. These preclude our using the number of cylinders as the measuring unit.

Cumulative number of bulk deliveries

We now turn to the second alternative, number of bulk deliveries. We note that the volume in bulk sales is rising very rapidly in recent years. In 1984, the government disclosed its intention to phase out LPG cylinders in twenty years' time. Meanwhile people have been talking about prohibiting delivery of LPG cylinders in passengers lifts in view of the potential hazard of gas leakage that may lead to explosion. This brings some changes in the supply pattern in the industry. More and more high rise buildings now have centralised LPG supply systems whereby the end-users get their supply through pipings carrying LPG in the vapour phase to their units from a centralised storage located near their building. The dominance of cylinder market is being challenged by the bulk

supply. In 1985, the cylinder sales of LPG for the whole industry experienced for the first time over the last twenty three years a negative growth of 1 %. The bulk sales will gradually replace the leading role of packed sales in a time frame of ten years. A great more emphasis is now placed on the operating cost of bulk business. A study of its behaviour will definitely help operation managers in devising means to control the cost to increase the profit margin.

LPG stored in the depot can be loaded directly into bulk lorries. The loading time depends on the volume to be loaded; for a five ton lorry it will take about twenty minutes. Usually a lorry is manned by two persons, the driver and a lorry-mate. The driver will be the person in charge of the loading-unloading operation, while the lorry-mate helps him in connecting pipelines, controlling valves, taking tank readings etc. When the lorry is fully loaded, the driver and the lorry-mate will start their journey to the bulk customers. Hong Kong is a small place; and every point in the territory that can be accessed by roads can be reached in one hour. Upon arrival at the customer's premises, the driver and the lorry-mate will reverse the loading procedure to unload LPG into the mini-storage tanks on the premises. It is a common practice in Hong Kong that vapour return line is not connected. A vapour return line is a pipeline that connects the vapour phase of the mini-storage tanks to the vapour phase of the lorry tank. The connection will speed up the unloading process, because when liquid LPG is pumped into the mini-storage tanks, the space of the vapour LPG inside the mini-storage tanks is constantly being reduced. If vapour is not withdrawn, as in the case when a vapour return line is connected, it will create a back pressure resisting the entry of further liquid LPG. Such back pressure acts against the pump and the speed of

unloading will be decreased. However, if vapour return is allowed, a vapour meter will have to be installed at the vapour return line and the pressure of the vapour returned has to be continuously recorded to deduce the amount of vapour returned to the lorry tank. The amount has to be credited back to the customer. The procedure is complicated and will invariably invite queries on the conversion factors used to convert the amount of vapour in cubic metres to an equivalent amount of LPG in kilogramme.

Unloading time depends on the volume to be unloaded and also other factors like the tank size, the pump capacity, the length of connecting pipes, the diameters of the pipes and etc. For a given customer and a given lorry, all other factors can be regarded as a constant and it will not be far off to say that unloading time is dependent on the volume to be discharged.

Costs incurred by the bulk operation also include those related to the use of the lorry. The cost is more related to the mileage of the lorry than other factors, as the life of the mechanical parts of the lorry and other essential components like tyres is inversely related to the mileage. Maintenance requirements are also very much related to mileage; in fact a number of maintenance is mileage-driven: a certain item to be checked when the mileage meter reaches a certain number.

The majority of bulk customers are located in the sub-urban areas or the satellite towns in the New Territories. In the urban area Towngas is a strong competitor. Though the price of Towngas in terms of dollar per unit energy is more than twenty per cent higher than LPG, the development of the latter is much handicapped by its requiring a localised storage near the customer. In the urban areas this requirement is simply not possible to be met with in most

of the cases. As a result the majorities of bulk customers are located outside the Towngas network in sub-urban areas or satellite towns like Tuen Mun, Yuen Long and Tai Po. These customers are thus more or less equal-distant from the oil depots which are located on the merge of the urban areas.

The number of deliveries made can thus be a good unit if we are to monitor some of the mileage-driven costs like the maintenance costs. With the growing significance in the bulk sector, this is an area that deserves some attention. At the present moment its scope is too narrow to justify its use to deduce the cost pattern of the whole LPG business.

Cumulative Number of Customer Accounts

The third alternative on our list is the cumulative number of customer accounts.

We have first to distinguish two types of accounts: direct and indirect. The direct accounts are those directly handled by the oil companies. These include the majorities of bulk accounts which have bulk storage facilities installed on their own premises. More attentions are given to these accounts because they usually are specific users consuming a large quantity of LPG. They have requirements of supply pressures and flow rates very much different from the domestic users. Each of these accounts may have unique contract terms that has to be taken care of; for example, the discount given to them may be on an escalating scale-- the more gas consumed, the higher the discount. In other cases, a certain account may have its plant closed for overhaul on some fixed dates every year. The despatch department has to be informed so that delivery of LPG will not be made during these days.

On top of these a licence issued by the Fire Services

Department for the bulk storage of LPG on the premises is required. Due to the keen competition, oil companies will usually do all the submission on behalf of their customers. Before the application is submitted, the oil company has to produce a set of design drawings showing the layout of the mini-storage and the pipeline arrangements. The amount of inputs is not much different for a customer with a small tank or another one with a tank twice as large. Thus as far as the marketing overhead is concerned, cost per account will more accurately reflect the experience-cost relationship for the bulk customers.

Another type of customers, the indirect accounts, are handled by the distributors. A record of the account is filed in the oil company. The updating of these records and administration work associated with the analysis of record data to draw meaningful implications for strategic marketing policies is usually taken care by a working team. The working team will utilise some of the resources of the company. For example, they need a library for the account records; they also drain off some of the resources in the data processing department in analysing their data.

The number of accounts also determines the number of distributor showrooms. There are a number of distributors working for an oil company. Each distributor operates several showrooms in different districts to take care of their business. The showrooms serve as an administration centre for the accounts in that district; it also displays LPG appliances for sale. Each of these showrooms is about thirty square metres in area. The routine running of the showroom is taken care of by the distributor. The oil company has its role to play in determining the strategic locations of the showroom, their layouts and decorations, and their unified way of

operation. The sales of each showroom is constantly monitored by the marketing people of its parent oil company.

The statistics of one of the oil companies shows that in 1985 for most of the showrooms the average number of accounts per showroom was around 2,000. There are some larger ones reaching 5,000 while the smallest ones were around 1,000. There are three reasons for this phenonmenon:

(1) Each showroom has its own overheads to cover: rent, utilities, wages for fitters and salary for the staff. This determines the mimimum number of accounts that it has to secure so that it is not operating at a loss. Those showrooms with too few accounts have to withdraw from the market sooner or later.

(2) Each showroom has its own length of reach. We recall that most of the packed cylinders have to be manually delivered. Typically the delivery man will either use a small cart to pick the cylinder from the store to the premises or he will use a bicycle. Some larger showrooms may use a small lorry fully loaded with the cylinders to drive to some convenience place from where the delivery man delivers to the end users. The use of small lorry will increase the length of reach but the distributor is still limited to his own area. There are also informal boundaries of operation between two showrooms in neighbouring districts. Should the boundaries be trepassed, the showroom being affected will invariably take revenge by offering discounts or gifts to customers of the trepassing showroom. This practice in the industry helps to shape the boundaries and each showroom becomes operative inside its sphere of influence. This length of reach heavily limits the number of accounts that a showroom can handle.

(3) When the number of accounts of the showroom is small, there is spare capacity in delivery and in administration. When the number of accounts grows, it comes to a point that further growth will make it necessary to employ more sales girls and more delivery labour, and to acquire more assets like lorries to deliver cylinders to and from oil company depots. Such increase in expenditure is not justified if the increase in the number of accounts is only marginal or the potential growth in new accounts is offset by the accompanying decrease in the number of old accounts due to other showrooms taking revenge.

One of the deductions that we can draw from the above analysis is related to the marketing overhead of the oil companies. It seems that for both the bulk customers and the packed customers, the marketing overhead is very much related to the number of accounts. It has to be cautioned that overhead expenses related to bulk accounts (e.g. licensing costs, engineering consultation to bulk customers) are in their nature different from those related to packed accounts (e.g. accounts analysis by the working team). Separate analysis is required if we want to go to that detail.

Cumulative volume of LPG sold

The statistics of cumulative volume is an aggregate quantitiy and does not differentiate itself into its components. This corresponds nicely with the statistics of the LPG direct costs which are also aggregate figures.

Very often we are more concerned about the unit cost, which is the total cost over the total quantity of a prescribed parameter. One extremely important point that might be overlooked is the mis-matching of the two parameters, cost and quantity. For

example, if the quantity is the number of cylinders handled, then the total cost must not contain any cost elements incurred by bulk LPG activities. Otherwise the interpretation of the unit cost is very complicated. It may involve justification of the assumption on the effects of 'contamination' by unrelated costs.

The perfect matching between the LPG direct costs and the total volume of LPG sold makes it strongly appealing to use the latter as a unit in measuring experience. A question that may arise is: Is it meaningful to analyse the total volume ? The answer is in the positive.

Firstly, the LPG market is defined by the total sales (as per previous discussions in the business definition). Analysis performed on aggregate quantities in this case will not sacrifice the detail resolutions required in other cases. Secondly, the cumulative amount of LPG sold by the company is a reflection of the effectiveness of the sales people in securing and keeping accounts, of the planning people in their projection of the future market, of the depot people in fulfilling the operational requirements, and of the top management in formulating the appropriate strategies. It will thus correctly summarise the overall effectiveness of the company in the LPG business. The cost analysis of the total volume will lead to meaningful managerial implications in formulating the company's strategies.

Thus while the other three measuring stakes are effective in measuring the performances in some areas of the business and can provide useful information for improving that area, none will give the overall picture of the business and summarise the total experience gained by the business except the total sales volume. The cumulative volume of LPG sold is thus selected as the parameter

for measuring experience.

Data Collection of Cumulative Volume of Sales

Volume of LPG is measured in kilo-litres. In Hong Kong, the total volume of LPG imported is published by the government alongside with other petroleum products though no imposts are applied on LPG. To match the LPG direct costs that we defined in the last section, the cumulative volume of LPG sold by the same company from which we obtain the cost data was utilised.

We recall that LPG was introduced into Hong Kong twenty four years ago. The cumulative volume should be counted from day one of the sales, that is, the sales figures as from 1962 must be collected and analysed. Unfortunately the sales record can only be traced back to 1970; any sales record prior to 1970 can no longer be located. The figures can be approximated by extrapolating the sales curve back to cover the first eight years. It can be seen later that the cumulative volume in the first eight years is only a small proportion to the total cumulative volume as at 1985. Deviation of actual figures, if any, from the approximation will not have significant effect on the overall derivation.

The above gives an account of how the marketing data of LPG in Hong Kong is utilised to verify the experience curve effect. From here on we will move to a more fundamental area related to competitive strategies -- the profitability.

Profitability

The second hypothesis that we postulated in the last chapter assumes that profitability is positively related to market share in the LPG business.

Two of the parameters mentioned have to be clarified before further analysis can performed. These are: market share and ROI.

Market share as defined in the PIMS study is the dollar sales in a given time period, expressed as a percentage of the total market sales volume. Return on investment is defined as the quotient of pretax operating profits over the sum of equity and long-term debt. Operating income is after deduction of allocated corporate overhead costs, but prior to any capital charges assigned by corporate offices.

Market share measurement is only meaningful if all the competing firms are defining the business in the same way. We have already shown that for the LPG business in Hong Kong all oil companies in Hong Kong are defining their business similarly. The whole market of LPG can thus be used to measure and compare the performances of the competing firms.

We further note that even though there is no formal agreement binding the oil companies, the list price of LPG is the same for all the competing companies. It was postulated (Ming Pao, 27/2/86) that the oil market in Hong Kong is too small that any price cut in one company attempting to enlarge the customer base will adversely affect the business of the competing companies, who as a result will follow the price cut to restore the former equilibrium. The oil companies in Hong Kong are well aware that such price-war will hurt all competitors. As a result the list prices of petroleum products are the same for all oil companies. Changes in prices are often announced by the market leader, followed immediately by other competing firms.

The list price is the ceiling price. Discount to large consumers is a usual practice and the amount of discount is up to negotiation. As the LPG market is at it maturing stage, the discount pattern of any one company, though confidential, is more or less known to his

competitors. Very often it is the close relationship with the customer that determines who gets the supply contract. Afterall in the private business sector no quotations are final. Competitors of the lowest bidder can always be invited by the potential buyer to negotiate for a lower or matching price. This contrasts sharply with the tender invited by Government, who will invariably award the tender to the lowest bidder though she is not bounded to do so. The annual consumption of LPG by the Government is around 1.5 % of the total throughput in Hong Kong. Over the last five years the government contracts have always been split and shared by different oil companies.

The portion of LPG sales that offers discounts is less than 10% of the total throughput. For the majority of LPG sold in Hong Kong the oil companies have more or less fixed unit proceeds. We will not be far off, therefore, if we redefine the market share as the volume sales in a given time period, expressed as a percentage of the total volume sales of the market; market being defined as the total LPG market.

The redefinition using the volume base rather than the dollar base will then coincide with our dimension in the measure of cumulative experience in the previous section.

The next parameter of ROI has to be adjusted slightly. As LPG is only part of the business of the oil companies, the 'equity and long-term debt' of the companies cannot be associated directly to it. ROI is thus redefined as the ratio of pretax profit over replacement value of capitals employed.

Source of Profitability Data

In 1985, one of the oil companies in Hong Kong employed an international consultant firm in strategic planning to carry out an

independent study of the relative cost positions of all the operating oil companies in order to highlight areas where costs can be reduced without sacrificing the qualities of the products and services. The scope of their project covered all the major products marketed by the company. The period covered was the whole year of 1984.

Much information were collected by the consultants. Their data base consisted of three groups of information :

(1) Data readily available from published date (e.g. amount of product imported into Hong Kong; number of filling stations etc.).

(2) Scattered information about the activities of the competitors accumulated by various departments of the company. The many pieces of information so provided were heavily used in constructing the cost structures of the competitors. As they are very scattered, much of the consultant's time was spent on compiling them and extracting meaningful clues from them.

(3) Opinions by field people. These opinions filled the gaps between the solid information. They were basically estimates made by field people like sales executives, operation staff and distributors under the guidance of the consultants.

High credibility was given to the report submitted by the consultants. The findings were summarised in a file of spreadsheet reports with the column showing the various products and the rows showing the various cost items for all the competitors. These figures were compared with the cost structure of the company itself. Several recommendations were drawn from the findings aiming at increasing the efficiency of the company by constantly monitoring the cost structure and progressively reducing some of the costs.

Though the data compiled by the consultant firm are mainly for

cost comparisons, they are extremely useful in studying the relationship between profitability and market share. The part of the data on LPG were extracted and further analysed to arrive at the profitability positions of the LPG marketers in Hong Kong. These will be shown in Chapter IV.

Summary

Summing up the discussions in this chapter, we are going to verify the experience curve effect by studing the experience/cost data of one of the five LPG marketers in Hong Kong. Experience is defined as the cumulative volume of LPG sold, while cost is defined as traceable costs solely incurred by the LPG business (with the exception of product cost).

The profitability and market share of the LPG business have also been defined. Their relationships are examined based on the cost and volume data in 1984.

The methods of data collection have been discussed together with the adjustments and assumptions involved.

In the following chapter we shall examine the data collected. In the final chapter the managerial implications drawn from the findings of the study will be fully discussed. We notice that the oil companies are very keen on finding a guideline for their operation in the SEZs in China, especially when there are so many uncertainties. The results of this study will help them to move one step backward and look at the marketing competition from a helicopter view of the determinants of competitive advantage that leads to an above-average performance in profitability.

CHAPTER IV

EMPIRICAL RESULTS

The empirical data presented in this chapter are commercial information the disclosure of which is not to the best interest of the data sources. They are thus systemmatically disguised to preserve confidentiality. In doing so two principles have been followed:

(a) The disguised data are to be consistent with each other.

(b) The critical parameters derived from the disguised data bear all the significant features of the original data. In other words, the conclusions drawn from the disguised data will be the same as from the original data.

Industry Sales Volume

The cumulative sales volume of the whole LPG industry in Hong Kong is shown in Table 1 and the graph is plotted in Figure 1. Market share positions are shown in Table 2.

The annual sales volume in the whole industry was 79,511 kL in 1970 compared with 411,230 kL in 1985; a five times increase over a time span of fifteen years. The figures also show that the growth rates are highest during early years. It can be seen that from 1983 to 1985, the LPG market has experienced three consecutive years of negative growth in the growth rate, and the trend is accelerating. These are signs that the market is maturing.

From Table 2 we can observe that the market share positions are extremely stable over the last fifteen years. The earliest data shown in the table were in 1970, eight years after LPG was introduced into Hong Kong. From that time onwards, the share

TABLE 1

SALES VOLUME OF LPG IN HONG KONG

Year	Total Industry Volume (kL)	Growth (kL)	Growth Rate (%)	Change in Growth Rate(%)
1962	2,119	2,119	/	/
1963	4,026	1,907	90.0	/
1964	7,248	3,221	80.0	-10.0
1965	12,321	5,073	70.0	-10.0
1966	20,946	8,625	70.0	0.0
1967	35,126	14,180	67.7	-2.3
1968	49,036	13,910	39.6	-28.1
1969	63,305	14,269	29.1	-10.5
1970	79,511	16,206	25.6	-3.5
1971	119,131	39,620	49.8	24.2
1972	163,036	43,905	36.9	-13.0
1973	198,776	35,740	21.9	-14.9
1974	195,543	-3,233	-1.6	-23.5
1975	213,103	17,560	9.0	10.6
1976	235,645	22,542	10.6	1.6
1977	243,733	8,088	3.4	-7.1
1978	272,596	28,863	11.8	8.4
1979	289,475	16,879	6.2	-5.6
1980	301,890	12,416	4.3	-1.9
1981	319,339	17,449	5.8	1.5
1982	350,130	30,790	9.6	3.9
1983	380,907	30,777	8.8	-0.9
1984	405,720	24,813	6.5	-2.3
1985	411,230	5,510	1.4	-5.2

Source: Planning Department, Company D
Note: All figures have been disguised to preserve confidentiality.

FIG.1 TOTAL SALES VOLUME OF LPG IN HK

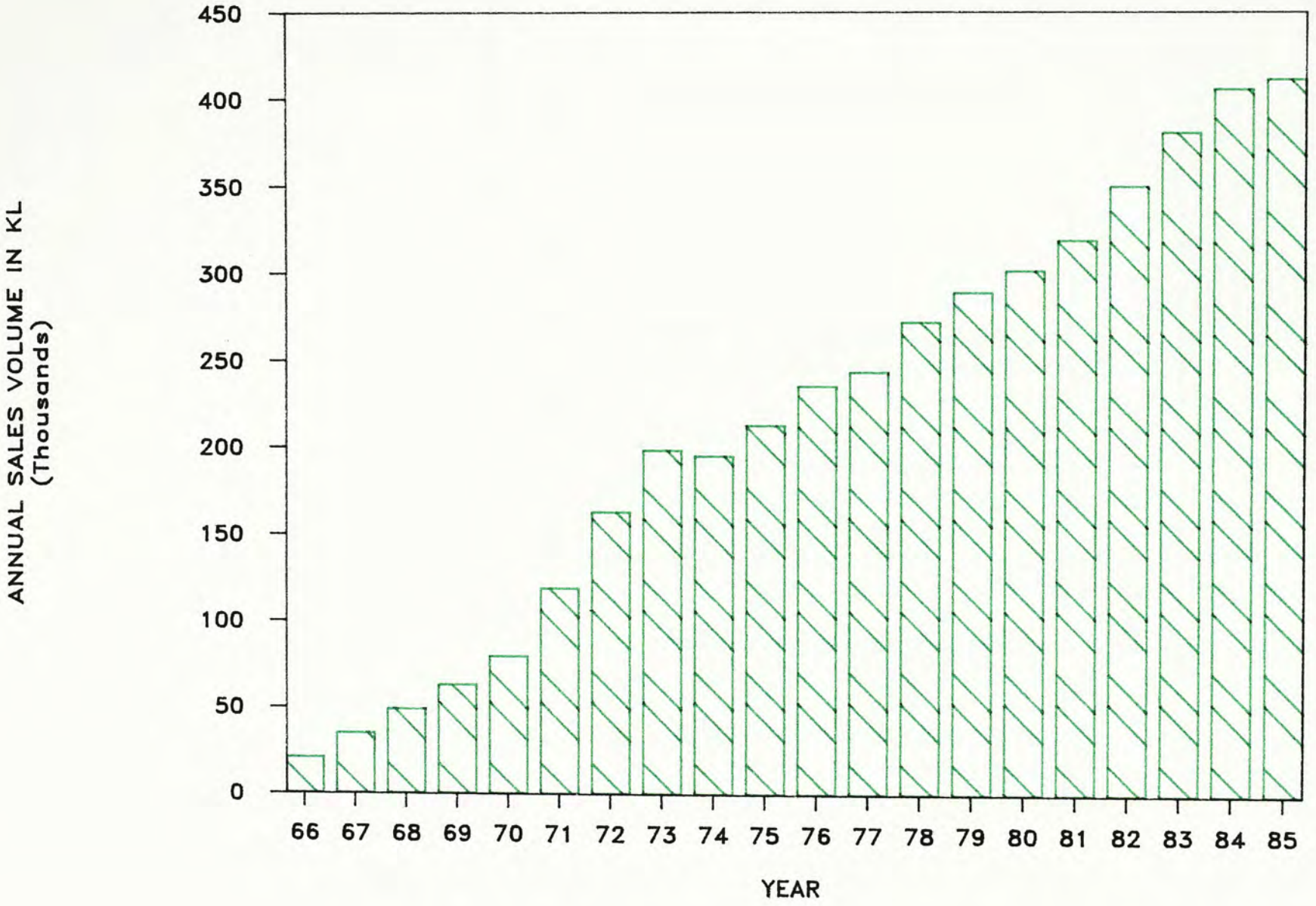


TABLE 2

MARKET SHARE POSITIONS

Year	COMPANY	Market Share (%)[a] A	B	C	D	E
1970		15.2	11.8	17.0	31.0	25.0
1971		16.7	10.1	16.0	32.5	24.7
1972		18.1	11.4	14.8	31.6	24.1
1973		19.5	12.1	14.9	30.3	23.2
1974		19.5	11.3	14.9	31.5	22.8
1975		19.1	11.6	14.3	31.9	23.1
1976		19.3	11.9	14.3	31.7	22.8
1977		18.8	12.1	15.7	30.8	22.6
1978		19.0	11.8	15.4	30.7	23.1
1979		19.2	11.5	15.6	30.6	23.1
1980		19.4	11.0	16.4	29.9	23.3
1981		19.0	10.6	16.8	30.0	23.6
1982		17.3	11.2	17.4	30.8	23.3
1983		16.9	11.1	17.6	30.8	23.6
1984		16.0	11.0	18.0	32.0	23.0
1985		15.5	10.9	18.5	32.1	23.0

Source: Planning Department, Company D
Note: All figures have been disguised.

[a]Market share in sales volume.

positions have only experienced very minor changes. The ranking in market share positions has been frozen.

Cost/Experience Relationship

We have postulated two hypothesis in Chapter II. The first hypothesis is repeated here:

H_1: Experience curve effect holds in the LPG industry.

To verify this hypothesis, the cumulative LPG sales volume of Company D and the associated LPG direct costs were collected and these are shown in Table 3A. The corresponding graph is plotted in Figure 2.

We recall that the experience curve is represented by the following equation:

$$C_N = C_0 N^i$$

where

C_N = cost of the N^{th} unit

C_0 = cost of the 1^{st} unit

N = cumulative number of units

i = learning index = log k/log 2

k = learning rate = 2^i

Rewriting the equation, we get,

$$\log (C_n) = \log (C_0 N^i)$$
$$= \log C_0 + i \log (N)$$

The equation can be written as

$$Y = A + BX$$

where

Y = log (cost of the N^{th} unit) = $\log C_N$

A = log (cost of the 1^{st} unit) = $\log C_0$

B = learning index = i

X = log (cumulative number of units) = log N

Rewriting the formula into the logarithm form will facilitate the derivation of the learning rate and the coefficient of correlation of the data. Table 3B shows the data in their logarithms.

A and B in the above equation are unknown quantities and the best estimates are the coefficients a and b in the regression line of the sample data. The regression line is represented by the following formula:

$$\hat{Y} = a + bX$$

where

X = log (cumulative LPG sales volume)

$a = \overline{Y} - b\overline{X}$

$b = (\sum XY - n\overline{X}\overline{Y})/(\ X^2 - n\overline{X}^2)$

Y = log (unit LPG direct cost)

From Table 3B,

$$b = \frac{25.057 - 5 \times 5.999 \times 0.836}{179.983 - 5 \times 5.999^2}$$

$$= - 0.484$$

$$a = 0.836 - (-0.484) \times 5.999$$

$$= 3.74$$

Note: Twelve decimal places are used in the above calculations. The figures shown are thus round-up figures.

Hence,

$$i = b = -0.484$$

$$k = 2^i = 2^{-0.484} \times 100\% = \underline{\underline{71\%}}$$

The slope of the regression line, which is the learning rate, is 71%.

TABLE 3A

COMPANY D: COST-EXPERIENCE RELATIONSHIP
IN LPG BUSINESS

Year	Cum. Sales Volume (kL)	LPG Direct Cost($'000)[a]	Annual Vol.(kL)	U. Cost (¢/L)	De-flator[b]	Adj. Unit Cost (¢/L)
1981	794,147	6,977	90,265	7.73	106.9	7.23
1982	893,507	8,459	95,802	8.83	117.9	7.49
1983	1,001,754	9,997	107,840	9.27	130.3	7.12
1984	1,122,023	11,462	117,319	9.77	143.2	6.82
1985	1,244,085	11,542	129,830	8.89	154.9	5.74

Source: LPG Department, Company D
Note: All figures have been disguised.

[a]LPG Direct Cost is defined in Chapter III. All costs in Hong Kong currency.

[b]The Hong Kong 1979/80 based Consumer Price Index (A) is used as the deflator.

TABLE 3B

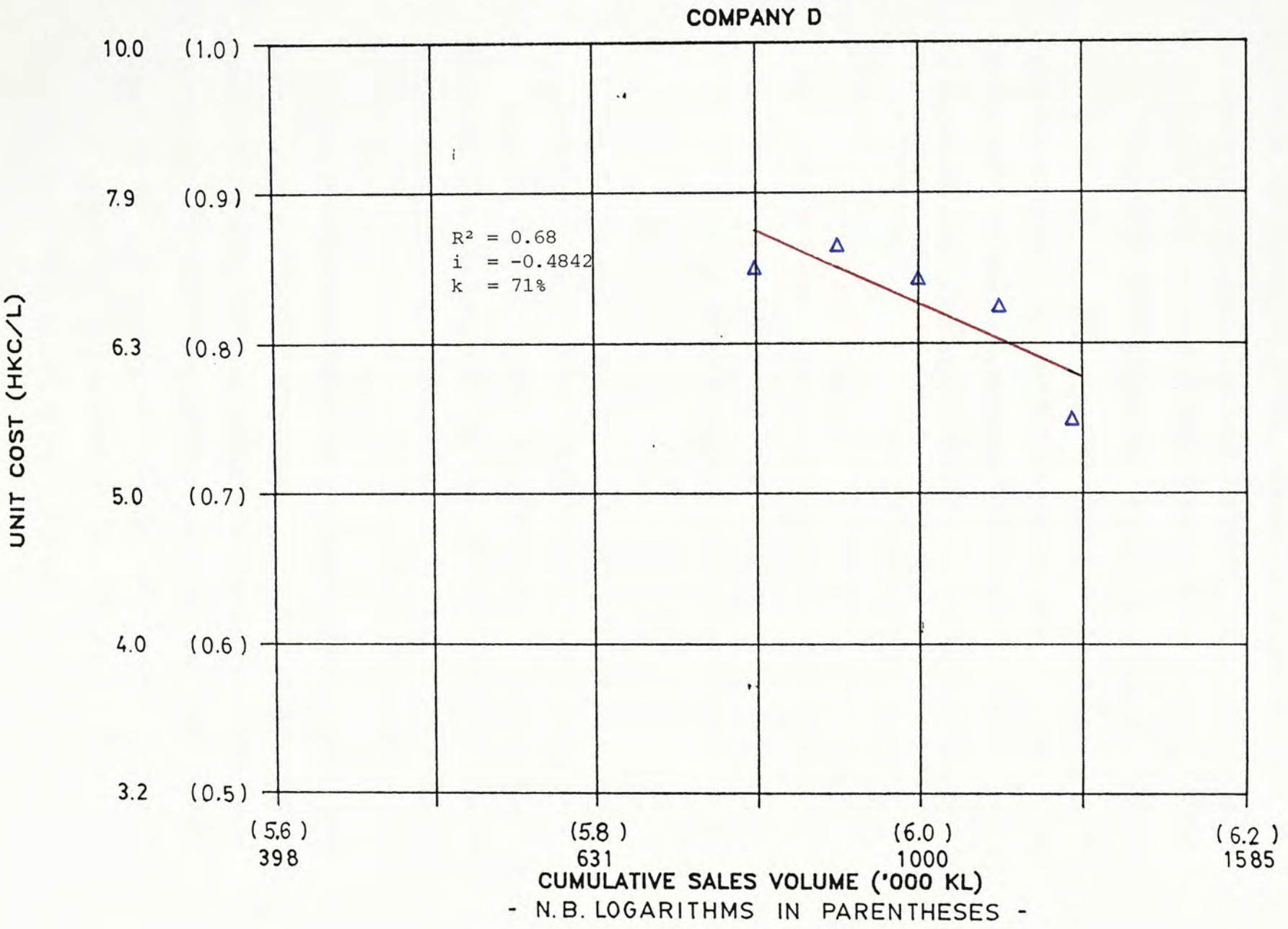
COMPANY D: REGRESSION EQUATION FOR EXPERIENCE CURVE

Year	X	Y	XY	X^2	Y^2	$Y-\bar{Y}$	Y	$Y-\hat{Y}$
1981	5.8999	0.859	5.068	34.809	0.738	0.023	0.884	-0.025
1982	5.9511	0.874	5.203	35.416	0.764	0.039	0.859	0.015
1983	6.0008	0.852	5.115	36.009	0.727	0.017	0.835	0.017
1984	6.0500	0.834	5.046	36.603	0.696	-0.002	0.811	0.023
1985	6.0948	0.759	4.625	37.147	0.576	-0.077	0.789	-0.031
Mean	5.9993	0.836	-	-	-	-	-	
Sum	-	25.057	179.983	-	-	-	-	

Source: LPG Department, Company D
Note: All figures have been disguised.

X= Log (Cumulative Sales Volume)
Y= Log (Adjusted Unit Cost)
$\hat{Y}$= a + bx being the regression equation. See discussion in this chapter.

FIG.2 EXPERIENCE CURVE FOR LPG BUSINESS



To test how well the empirical data fit into the regression line, we have to calculate the coefficient of determination, r^2. r^2 is a measure of the degree of fitness between the sample data and the regression equation. Its value falls between 0 and 1. A value close to zero suggests that there is little linear correlation between X and Y. A value close to 1 means that there is a strong relationship between X and Y, and the relationship is expressed by the regression equation. As the equation shown below suggests, r^2 is also the ratio between explained variation and total variation from the regression line of the sample data.

By definition,

$$r^2 = 1 - \frac{(Y - \hat{Y})^2}{(Y - \bar{Y})^2}$$

$$= 1 - (0.008209/0.002603)$$

$$= \underline{\underline{0.68}}$$

Thus 68% of the variation in LPG direct cost was explained by the regression equation. Given that two thirds of the variation in the sample data are 'explained' by the regression line, we conclude that a relationship exists between the two variables X and Y in our sample data.

The conclusion is derived from the sample statistics, which may differ from the population parameters. To check against possible errors of concluding from our sample data that an association exists between the LPG direct costs and the cumulative sales volumes, while actually no such relationship exists in the complete series of data of which our sample data form a part, we can test the hypothesis that the population correlation, ρ, is zero (implying that no relationship

exists between X and Y in the whole population). That is, we wish to test the null hypothesis that $\rho = 0$ against the alternative that $\rho \neq 0$. We may write:

Null hypothesis: $\rho = 0$

Alternative hypothesis: $\rho \neq 0$

For small sample size, the t statistic is used to test the hypothesis.

$$t = (r - \rho)/S_r$$

$$= r/\sqrt{(1 - r^2)/(n - 2)}$$

where

r = sample coefficient of correlation = $\pm\sqrt{r^2}$

The sign of the root to be the same as the coefficient b in the regression equation.

ρ = population coefficient of correlation

S_r = estimated standard of error of r

n = number of data pairs

Since

$$r = -\sqrt{0.6828}$$

$$= -0.8264$$

$$n = 5$$

Substituting into the equation,

$$t = -0.8264 / \sqrt{(1 - 0.6828)/3}$$

$$= \underline{\underline{2.54}}$$

Referring to t table, the critical values of t at 5% and 10% levels of confidence for three degrees of freedom are 3.182 and 2.353 respectively. The computed value of t is not significant at the 5% confidence level but significant at the 10% confidence level. We can weakly conclude that a positive relationship exists between the

cumulative sales volume of LPG and the direct LPG costs.

The best estimate of the relationship is provided by the regression line, which in this case is the experience curve for the LPG direct costs. We therefore conclude that experience curve effect holds in the LPG industry. The slope of the experience curve is 71%, meaning that by doubling the cumulative sales volume, the unit LPG direct costs will be lowered by 100% - 71% = 29%

Profitability

The before-tax profits and the replacement values of capital employed by the five LPG marketers in Hong Kong are listed in Table 4. All figures refer to 1984 positions.

The second hypothesis we put up in Chapter II is:

H_2: Profitability is directly related to market share in the LPG industry.

We are going to test this hypothesis by the above data.

Let X be the ranking of the LPG marketers in market share positions, 1 being the highest market share. Also let Y be the ranking in before-tax return on investment.

Company	X	Y	Difference= X-Y	$d^2= (X-Y)^2$
A	4	4	0	0
B	5	5	0	0
C	3	2	1	1
D	1	1	0	0
E	2	3	-1	1
			Total :	2

The Spearman rank correlation, r_r, is a measure of the correlation between two ranks. The correlation can assume a value

TABLE 4

PROFITABILITY ANALYSIS -
LPG SALES IN HONG KONG

	COMPANY				
	A	B	C	D	E
Sales Volume (kL)	64,915	44,629	73,030	129,830	93,316
Market Share (%)	16.0	11.0	18.0	32.0	23.0
Profit, Before Tax[a]	12,597	3,341	20,208	32,104	17,376
Replacement Value of Capitals employed[a]	206,175	111,355	223,288	290,795	278,467
ROI, Before Tax (%)	6.11	3.00	9.05	11.04	6.24
ROI Ranking	4	5	2	1	3
Market Share Ranking	4	5	3	1	2
% Share In RVCE[b]	18.4	9.9	19.9	26.0	24.9

Source: Planning Department, Company D
Note: The table shows the positions in 1984.
All figures have been disguised.

[a]Unit in HK$'000

[b]Ratio of replacement value of capitals employed by one company to the total value in the whole industry.

ranging from -1 to +1. In case of perfect correlation between the ranks, r_r will either be +1 for direct correlation or -1 for reverse correlation. On the other hand, an r_r of zero indicates no correlation between the ranks. Values close to +1 or -1 imply strong correlations while values close to zero imply weak correlations.

By definition,

$$r_r = 1 - ((6\sum d^2)/ n (n^2 - 1))$$

where

d = difference between rankings

n = number of data pairs

For our sample data,

$$r_r = 1 - 6 \times 2 / 5(25 - 1)$$

$$= \underline{\underline{0.9}}$$

The significance of the rank correlation can be tested by the t statistic applied to the sample correlation coefficient.

$$t = r_r / \sqrt{(1 - r_r^2)/(n - 2)}$$

Substituting $r_r = 0.9$ into this equation,

$$t = 0.9/ \sqrt{(1 - 0.81)/3}$$

$$= \underline{\underline{3.57}}$$

Using the two-tailed test of null hypothesis of zero correlation in the ranked data of the population (in this case the LPG business as a whole), we note from the t table that at 5% level of significance, the critical value of t is 3.182 for three degrees of freedom.

As the t value is larger than the critical value, we reject the hypothesis of no rank correlation. We thus conclude that a positive relationship exists between the rankings of the market share positions and the before-tax ROI. It follows that the higher the market share, the higher the profitability will be.

Conclusions

From the above analysis we can draw the following conclusions for the LPG market in Hong Kong, keeping in mind that these conclusions can be applied to SEZs as discussed earlier on:

(1) Experience curve effect can be observed in the LPG market. The LPG direct costs are declining on a 71% slope over cumulative volume.

(2) Profitability of the LPG business is directly related to the market share position. The higher the market share, the higher will be the profitability.

We thus conclude that the two hypotheses postulated in Chapter II of this report are verified by the empirical data. This conclusion has significant implication to the LPG marketers in formulating their strategies in SEZs. This will be fully discussed in the next chapter.

CHAPTER V.

MANAGEMENT IMPLICATIONS FOR LPG MARKETERS IN SEZs

There are only five oil companies that market LPG in Hong Kong. During the first ten years after LPG was introduced into Hong Kong in 1962, the annual growth in the industry volume was over 20 %. Then there was a sudden drop in volume in 1974 following the economic chaos in 1973. The annual growth in industry volume then followed an erratic pattern until the recent four years that witnessed a steady drop in the annual growth rate from 9.6% to 1.4%. One of the reasons for a steady drop in volume is the expansion of the towngas network into many existing housing estates which used to consume large quantities of LPG. The government is encouraging piped-gas systems and has made known to the industry that cylinder LPG will be gradually phased out. Piped-gas can either be towngas or bulk LPG. In the existing housing estates, towngas is in many cases the only choice because the old estates were so crowdedly built that it is totally impossible to spare some space to house a mini-storage tank on the premises. In these areas the market of LPG is in fact shrinking. But in other areas LPG is quickly taking the place of kerosine, and this replacement has contributed to the continual growth of the market. It was estimated by the industry that as more and more kerosine customers have shifted to LPG, the growth in the LPG market will be diminishing. It is highly unlikely that there will be a reverse trend.

As the market in Hong Kong is gradually saturated, the five oil

companies are facing new opportunities in the neighbouring areas. The announcement of opening four SEZs to foreign investors has special meaning to the oil companies, some of which have operated in the China market before 1949 when the People's Republic of China was formed. Some of the special features of SEZs have been discussed; and it will suffice here to have a second look from the eyes of the oil companies why the market is attractive. We have discussed the two different ways in which LPG is delivered to the end-users: by cylinders or by bulk. Two of the larger SEZs, Shenzhen and Zhuhai, are bordering Hong Kong and Macao and bulk lorries or packed lorries can easily load the products in Hong Kong and Macao, cross the border and road-deliver to consumers in SEZs. The third SEZ, Shantou, is about 300 kilometres from Hong Kong. Accessible by paved road, Shantou is now supplied with packed LPG from Hong Kong. The oil companies are also looking into the possibility of delivering LPG to Shantou, Zhuhai and Xiamen by barge; the same mode of transport is employed in delivering LPG to Macau and outlying islands of Hong Kong. In short, the SEZs can be regarded as an extension of the Hong Kong market, at least geographically speaking, and it is technically feasible to deliver LPG to these areas either in bulk or in packed.

There are of course some differences from domestic sales, e.g. customs clearance is required when crossing the border; foreign exchange has to be arranged to channel the earnings back to Hong Kong. But these differences are minimised, or in other words, the problems associated with the differences were solved by the special provisions granted to trading activities in SEZs by the Chinese government as we have discussed in detail in the previous chapters.

The ease in which LPG can be marketed in SEZs has encouraged

the five oil companies in Hong Kong to take serious consideration about setting up small depots in SEZs so that bulk products can be shipped to these areas directly. In this case the parent company in Hong Kong will probably provide the necessary technical back-up and administration support while some locals are trained to take up the operational routines. This is a similar consideration when one of the oil companies in Hong Kong set up a second depot on Hong Kong island to take care of the business on the island, leaving the main depot in Kowloon to cater for the need in Kowloon and the New Territories. In short, the oil companies are faced with the problem of how to compete in these new markets, the settings of which are so similar to Hong Kong, to gain competitive advantage over others. Our analysis in the preceding chapters give some hints to the strategy formulation.

Experience Curve Effect

Our study shows that the related costs of marketing LPG in Hong Kong follows a 71% experience slope. It is postulated that similar experience curve effect should be observed in the similar markets in the SEZs.

It has been argued that experience curve effect does not just happen, but is a result of careful coordination and management of different facets of the business (Abernathy and Wayne 1974). Our analysis does not show the reasons behind the experience curve effect; rather, it verifies that the theory is applicable to the Hong Kong market. It is the likelihood of achieving such an effect that bears significant signals to the practising managers in Hong Kong. It suggests that the company who succeeds in securing the highest cumulative sales volume in the SEZs will have the promising result of achieving the lowest unit cost. In the long run this company will be

more profitable than its competitors and is less vulnerable to the variations in selling price and product cost. In the former case if there is a downward selling price movement across the industry the company with the lowest unit cost will be more comfortable because of the larger margin that it enjoys. In the latter case, the product cost fluctuates with the worldwide supply and demand situation. Should there be any upward movement in the product cost all operating companies will be equally affected. The company with the lowest operating cost will be able to stand the situation if the selling price is locked due to government regulation or the ceiling is restricted by some long-term contracts.

The validity of the experience effect also provides the opportunity to forecast future cost in marketing LPG in SEZs. In building up the volumes in SEZs, oil companies will invariably be required to invest heavily in setting up the logistics. Small oil depots will be required to be built; local delivery teams have to be organised; receiving facilities to unload the product directly from tankers may be considered; local distributors and showrooms have to be set up and so on. These capex investments have one common element: a long time frame in which the cash flow projections must be carefully considered. In most of these project evaluations the economics assumes a unit cost that escalates with inflation. This could lead to the incorrect conclusion that some projects are not viable, which may not be the case if the experience curve effect is being considered.

The result also suggests the possibility that the unit cost in Hong Kong will be further lowered due to increase in total volume when sales in SEZs are included. This area has not been fully investigated, and a clue to the solution is the definition of the

business-- whether the two markets (Hong Kong and SEZs) can be defined as one single market or must be considered separately. This area will be of interest to the operating companies; but as it is not directly related to our scope we are not going to pursue further.

Market Share Implication

The analysis of experience-cost relationship shows that the company with the highest cumulative experience will gain the highest profitability. This is echoed by the 1984 profitability analysis of the five oil companies in Hong Kong, which shows that Company D, the market leader for over fifteen years out of the whole history of LPG marketing in Hong Kong for twenty four years, in fact gained the highest profitability. The ranking of profitability follows closely to the ranking in market shares for the other companies.

The result is in line with the many other researches on other industries. It hints that market share can be one of the primary marketing objectives in the potential markets in SEZs to which Hong Kong market has proxied. We recall that in SEZs, there are local supplies of LPG of inferior quality at a much lower price, and we have excluded the local supplies from our analysis as they are operating under very different marketing parameters. It is not surprising that the local supplies will secure a very high portion of the market. Keeping this in mind, the results of our analysis provide the answer for the foreign oil companies in formulating marketing strategies to achieve competitive advantages over the other foreign oil companies. It strongly suggests that market share is an indicator of performance in the LPG market. If a company is in pursuit of an above-average performance, then the company must monitor its market share position carefully and move strategically into a high market share position.

In our analysis of the market definition we conclude that all oil companies are competing in a market that is identically defined by all the participating companies. When we suggest that a company should move into a high market share position, it refers to the total LPG market. Our study does not deprove that focus should not be practised, rather, it shows the LPG market in Hong Kong and in SEZs is inherently denying focus. The different market segments do not contain sufficient features for any differentiation to present itself smartly to the customer.

Other Implications

Two interesting phenomena revealed by the data and deserve some discussions are (1) the stable market share positions over the years, and (2) the relationship between the market shares and the ratio of replacement values of capitals employed by the companies.

Stability of Market Share Positions

Our data shows that the market share positions of the five oil companies have practically unaltered during the past fifteen years, despite their keen competition to acquire new accounts as shown by the fierce bidding for government contracts and exclusive rights to supply gas to housing developments. Though the data about market shares in the initial nine years after LPG was introduced into Hong Kong in 1962 were not available, it is not unreasonable to assume that the same market share positions were formed at the very early stage of product introduction, probably in the first five years.

We have noted that people in China has been using coal and wood as the primary domestic fuel for many years. LPG is new to them, as what happens in 1962 when LPG was brought into Hong

Kong where most people used kerosine. The oil companies seized the opportunity to explore the virgin market in Hong Kong, expanded their storage capacity and handling facilities, and extended their servicing network. Total volume grew from nil to 80 million litres per annum in 1970, eight years after the product was introduced. The same oil companies are facing the similar situations today. Our findings lead us to conclude that early entry into the market and quickly establishing the share is of paramount importance. The Hong Kong experience reveals that in subsequent years the share positions simply stayed where they were no matter how hard each individual company competed with each other. To enter into the LPG market in China will require substantial capital investment to construct the various facilities. The risk of high initial cash outlays has to be balanced carefully with the benefit of early entry.

We are not suggesting that any one company can fight into the market, secure a high market share and then relax for the rest of the years hoping the share to take care of itself. The presence of hard competition in subsequent years, as in the case of Hong Kong, demonstrates that it is the dynamic forces of interaction amongst the participating companies that help restore the 'equilibrium' share position. The withdrawal of any one force will distort the balance resulting in a new 'equilibrium'.

Market Share and Asset Share

Asset share here means the ratio of the replacement value of capitals employed by one company over the value employed by the whole LPG industry.

From our data we can identify strong association between the two. The capitals employed by a company in the LPG market have the following major components:

- storage facilities
- filling facilities
- bulk delivery facilities
- dispensing equipment installed on customers' premises
- cylinders

All these items relate closely to the volume to be handled. Excess facilities means that a company is operating under capacity, which in turn increases the unit running cost. Every company will thus try to match its volume with the amount of equipment to ensure a high utility rate is achieved. At the initial stage the market size is constantly expanding, so is the amount of equipment owned by each company. There comes a point when the total amount of equipment owned by all the companies is sufficient to cater for the need of the market. Further expansion of one company will invariably result in an over-capacity for the whole industry, and some members will suffer by running at sub-optimal level. The member who suffers most will either withdraw some of his capacities or fights to secure extra volume at the expense of other members. In the long run the loss will ultimately be shared by all the members. An 'equilibrium' stage is then reached in which any member who expands his capacity will suffer first for a certain period of sub-optimal capacity operation until he can gain extra volume, probably by special offers to existing customers of his competitors. This 'penalty' is a deterrant force that prevents a company from expanding other than to a level consistent with the natural market growth. The large amount of capital required to expand and the fact that capacities can only be increased in steps and not differentially further strengthens the force.

The above two observations are not the main themes of this

research and thus they are not covered by our theoretical framework. However, they do provide some insights into the LPG market and deserve further research efforts.

APPENDIX 1

SPECIAL ECONOMIC ZONES

In 1979 China announced the establishment of four Special Economic Zones (SEZs): Shenzhen, Zhuhai, Shantou and Xiamen. The following sections will briefly give an introduction to these four zones to facilitate an understanding of the marketing environments. They should be read in conjunction with the first chapter in which the backgrounds leading to the establishment of SEZs and the linkage between these SEZs and Hong Kong are discussed.

The materials in this appendix are extracted from the following documentations:

(1) China Handbook (1985)

(2) Shekou Industrial Zone of China Merchants Steam Navigation Co. Ltd. in Shenzhen Economic Zone of Guangdong Province of the People's Republic of China (1983)

(3) Investment Guide for Shenzhen Special Economic Zone, Guangdong Province, People's Republic of China (1982)

(4) The Asia Journal of Public Administration (Dec, 1985)

(5) An Open Coastal City-- Zhuhai (1984)

Shenzhen

Geographical Situation

The Shenzhen Special Economic Zone is the largest of the four Special Economic Zones (SEZs). It is located on the coastal area of Guangdong Province of the People's Republic of China extending from 113°17'E to 114°18'E in longitude and from 22°23'N to 22°43' N in latitude. It borders on by the New Territories of Hong Kong in

the south, the Wutong Mountain and Yangtai Mountain in the north, Dapeng Bay in the east and Houtai Bay in the West.

Area and Population

The total area is 327.5 sq. kilometres. The population in the zone in 1982 is 98,000 out of a total municipal population of 330,000.

Administration Division

The long and narrow shaped Shenzhen is divided into four administrative districts:

Lowu District-- 74.2 sq. kilometres and a major commercial area.

Shangbu District-- 68.8 sq. kilometres in area, in the central part of the SEZ, terminus of highways and connected to Hong Kong by a ring-road, the SEZ's administrative and commercial centre.

Nantou District-- 119.5 sq. kilometres in area, a comprehensive processing area, an important service base for offshore oil exploration.

Shataojiao District-- 65 sq. kilometres in area, to be developed into a seaside resort and a tourist centre.

Scope of Development

To Shenzhen, industry is the key development aspect. Industrial items with advanced techniques and equipments and those avoiding environmental pollutions are most welcomed by the SEZ.

Electronics industry: items include electronic components and devices, electronic instruments, meters and special equipments, computers, micro-processors, radio communication and navigation aids, new electronic materials, electronic products for consumers' use, new broadcasting and television products.

Petrochemical industry: refining and processing of petroleum, and

such petrochemical industry as producing synthetic fibre, synthetic resin, and synthetic rubber.

Foodstuff industry: processing industry producing high-class confectionary, high-class beverage, high-class nutritional foods, instant foods, tourist foods, and high-class cigarettes.

Light industry: manufactured goods for daily use, high-class furniture, plastic products, and printing products, stationery, electrical appliance for daily use, high-class cosmetics and chemical products for daily use.

Textiles and garments industry: textile trade producing high-class cotton, wool and chemical fibre; high-standard garment design, tailoring and processing trade.

Building materials industry: production of marbles, high-grade cement, light-duty synthetic building materials and sanitary wares; remaking of metallic materials and production of building and decoration products.

Machinery industry: production of advanced electric appliances and equipments for household use, refrigerating equipment, elevators and various advanced machine tools; remaking of automobiles and ship repair.

Ten industrial sectors are identified as well:

Shangbu-- electronic industry

Bagualing-- various kinds of industries

Liantang-- textile industry

Shuibei-- hardware and machinery industries

Futian-- various kinds of industries

Chegongmiao-- various kinds of industries

Shahe-- various kinds of industries

Houhai-- various kinds of industries

Shekou-- various kinds of industries

Nantou-- various kinds of industries

It is anticipated that by the year 2000, 1,500 factories will be built in Shenzhen.

Shenzhen, to the Chinese government, is to develop into a comprehensive Special Economic Zone with stress on industry and parallel developments in agriculture, commerce, husbandry, tourism, housing and scientific research.

Zhuhai

Geographical Situation

Zhuhai is situated on the west bank of the Pearl River estuary, in the south of Guangdong and links with Hong Kong by a sea route of 36 nautical miles. It borders to Macao in the south.

Areas and Population

Zhuhai covers a total of water and land area of 7,602 kilometres, 1,630 kilometres of which is land area.

Zhuhai was originally a small county of Guangdong province with a population of only 130,000.

Administration Division

In July 1979, in accordance with the opening-up policy adopted by the State Council, the Zhuhai county was given municipality status. Zhuhai is divided into two districts and one county:

Urban District-- Xiangzhou District covering an area of 6,611 sq. kilometres, 639 sq. kilometres of which is land area.

SEZ-- covers an area of 15.16 sq. kilometres.

Doumen County-- covers an area of 976 sq. kilometres.

The whole zone is under the jurisdiction of the Zhuhai Special Economic Administrative Committee.

Scope of Development

The initial plans called for the division of the zone into four separate areas with 45 % of the land to be devoted to industrial enterprises. The 1982 plan projected three districts:

Gongbei District-- borders Macao; it would house the industrial park development and central administration area;

Jida District-- slated for tourism;

Wanzi District-- allocated principally for residential and office uses.

In 1983, in response to local pressure, the State Council approved doubling the size of the zone out of which 90% were designated for industrial development. The focus of industrial development was to be on electronics and building materials, particularly glass and ceramic, and long-term zone development plan is partly hinged on the development of the Macao economy, and the success of the oil development in the South China Sea.

Shantou

Geographical Position

The city of Shantou is situated on the Chaoshan Plain on the south-western coast of Guangdong province, facing the South China Sea. The Shantou SEZ initially covered only 1.67 sq. kilometres of Longhu Village on the eastern skirts of Shantou City, 3 kilometres from the city proper.

Area and Population

Shantou in 1980 was a medium sized city, its greatest metropolitan area containing 720,000 people on 245.5 sq. kilometres and its urban core (Shantou proper) contains 416,000 people on the 7.25 sq. kilometres.

Scope of Development

As per the plan in 1983, Shantou was not to build a "comprehensive" Zone as was being undertaken in Shenzhen and in particular was to avoid any focus on property development. Rather, its main emphasis was to centre on developing a process industry, in conjunction with the development of its agricultural activities. The key to the zone's further development was the industrial processing area at Longhu Village where a core industrial site of 1.6 sq. kilometres and an adjacent warehousing and residential area of 1.2 sq. kilometres would be developed. It was proposed to build 200,000 sq. kilometres of multi-purpose, multi-storey industrial building, expected to accommodate a total of 250 light industrial enterprises employing 50,000 staff and workers and producing an annual output valued at 380 million yuans upon completion.

Shantou has got a very good basis for her own development. With a modest old port area, Shantou has been involved in international trade for over a century. It can handle two million tons of freight a year. 120 of its 350 factories and enterprises (in 1983) were engaged in production for export. Total industrial output for 1981 was valued at over 800 million yuan.

Xiamen

Geographical Situation

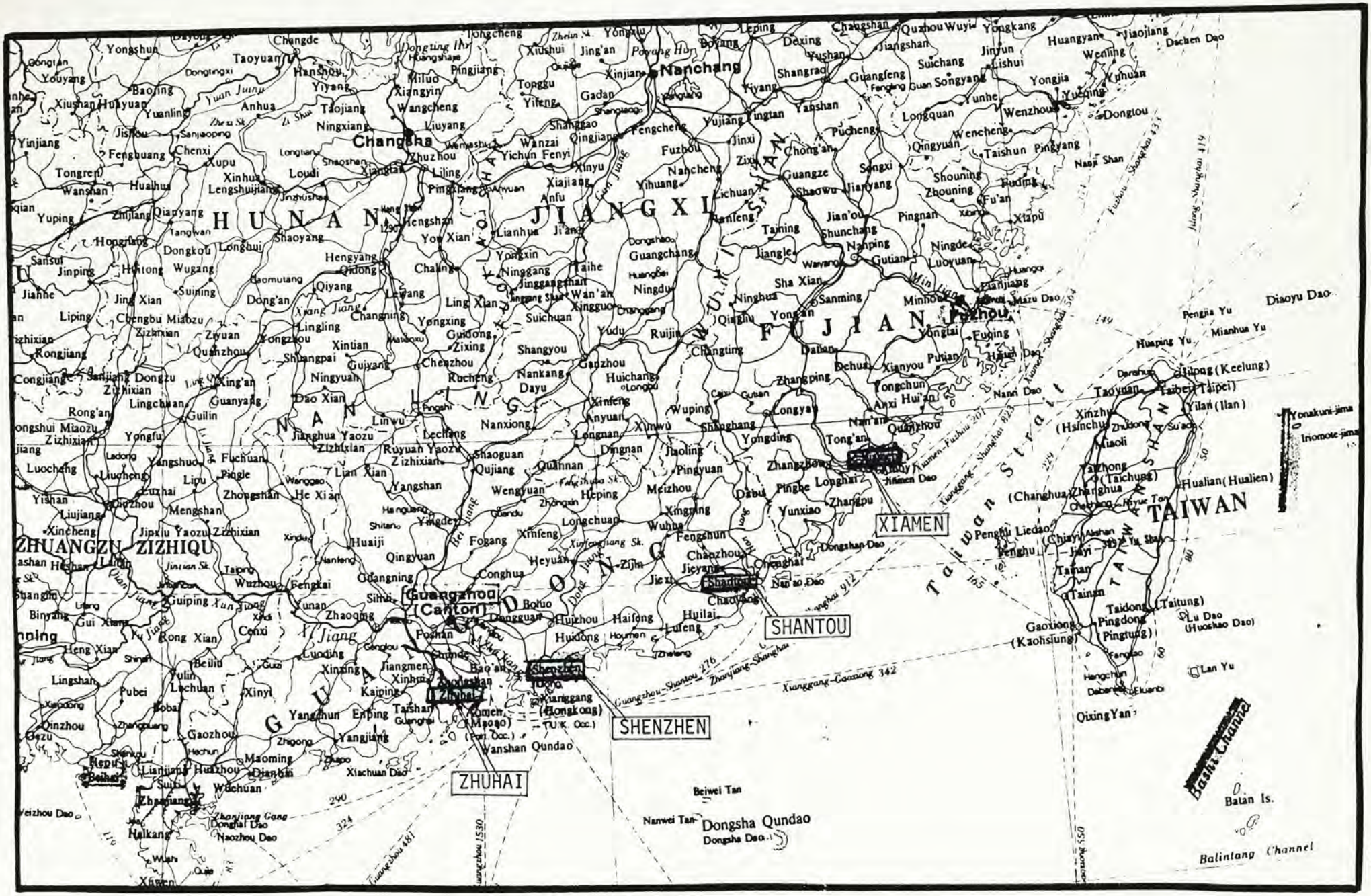
Xiamen, formerly known as Amoy, is a municipality in South-eastern Fujian province.

Area

In 1980 the site in the north-west sector of Xiamen Island was chosen for the Xiamen Special Economic Zone. The SEZ covers only 2.5 sq. kilometres. In the course of its development, 820,000 sq. metres of land have been levelled. Since March, 1984, the Xiamen SEZ was considerably enlarged to 131 sq. kilometres.

Scope of Development

Xiamen is an old trading port with a good natural harbour, rail links to the interior and a modest light industrial base consisting of 770 factories and an industrial workforce of 100,000 producing over 2000 products. The region's solid educational and technical foundation levels and its location in a productive agricultural region offer solid support for an export development effort as well as a market for the products of zone-based enterprise. From the outset, there was a twofold thrust to development plans for the zone-- first to develop a small 2.5 sq. kilometres industrial zone at Huli (in north-west Xiamen) adjacent to the new port at Dongdu. The second aim was to oversee the technological renovation of Amoy's older export oriented industries on the basis of foreign investment. The plan also anticipated rapid growth in industrial output from the 1982 level of 1.2 billion RMB to over 6 billion RMB by the year of 2000.



LOCATIONS OF SPECIAL ECONOMIC ZONES

APPENDIX 2

FORM OF FOREIGN INVESTMENTS AND SPECIAL LAWS IN SEZs

Form of Foreign Investments

The forms of foreign investments in the SEZs can be summaried as follows (China Official Year Book 1985):

(1) Enterprises entirely run by foreign investors.

(2) Ventures with Chinese and foreign capital - shareholders hold common responsibility for profits and losses.

(3) Cooperative enterprises - funds, industrial equipment and materials are generally supplied by foreign businessmen while land, factory building, labour force and services are provided by China. Profit distribution is in accordance with the contracts signed,

(4) Processing materials - Chinese factories are to process materials provided by foreign firms into finished products. Service charges will be paid to the Chinese.

(5) Compensation trade - in which credit, not cash, is used for settling accounts. China will use commodities or services instead of cash to pay for the equipment and techniques provided by foreign contractors.

Special Laws

The interests of the foreign investors are protected by the special laws and regulations on Special Economic Zones. These laws and regulations spelt out the general principles, registration requirements and operation details, preferential treatments, labour management, foreign exchange arrangements and tax treatments. The

'Regulations on Special Economic Zones in Guangdong Province' approved by the 15th Session of the Standing Committee of the 5th National People's Congress on 26th August, 1980 provides some insights. It contains the following terms:

- In the special zones, foreign citizens, overseas Chinese, compatriots in Hong Kong and Macao and their companies and enterprises are encouraged to open factories or set up enterprises and other establishments with their own investment or undertake joint ventures with Chinese investment. Their assets, due profits and other legitimate rights and interests are legally protected.

- Enterprises and individuals in the special zones must abide by the laws, decrees and related regulations of the People's Republic of China.

- All items of industry, agriculture, livestock breeding, fish breeding and poultry farming, tourism, housing and construction, research and manufacture involving high technologies and techniques that have positive significance in international economic co-operation and technical exchange, as well as other trades of common interest in investors and the Chinese side, can be established with foreign investment or in joint venture with Chinese investment.

- Investors can open accounts and deal with matters related to foreign exchange in the Bank of China in the special zones or other banks set in the special zones with China's approval.

- Products of the enterprises in the special zones are to be sold on the international market. If an enterprise wants to sell its products in the domestic market in China, it must have the approval of the Guangdong Provincial Administration of Special Economic Zones and pay customs duties.

- Investors can employ foreign personnel for technical and

administrative work.

- Machinery, spare parts, raw materials, vehicles and other means of production for the enterprises in the special zones are exempted from import duties.

- The rate of income tax levied on the enterprises in the special zones is to be 15 %.

- Investors who reinvest their profits in the special zones for five years and longer may apply for exemption from income tax on the part of the profits reinvested.

- The employees of the enterprises in the special zones are to be managed by the enterprises according to their business requirements, and if necessary, can be dismissed in line with the provisions of the labour contracts.

APPENDIX 3

LIQUEFIED PETROLEUM GAS

Liquefied Petroleum Gas, or LPG as people commonly call it, refers to a group of organic gases belonging to the alkane or alkene family that can be liquefied in room temperatures by the application of pressure. These gases may come from natural reserves, or from refinery. The basic components of LPG are propane and butane. As a fuel, LPG is usually supplied in either one of the following: commercial propane, commercial butane, commercial propane/butane mixture or special duty propane. The choice amongst these depends on the application and also the air temperature of the region concerned. We can view propane and butane as two extremities; propane has the highest vapour pressure while butane the lowest. Any mixture of propane and butane will have an intermediate vapour pressure in proportion to the composition. The more propane it contains, the higher the vapour pressure.

Another important property of LPG is that the vapour pressure drops with the temperature. We need a certain minimum vapour pressure to operate LPG. In cold areas commercial butane exhibits too low a vapour pressure to be operative, and LPG with a higher propane content has to be used. SEZs are located in the sub-tropical areas and just like Hong Kong, LPG is supplied in the form of propane/butane mixture with a propane: butane ratio of around 30: 70.

LPG is a high-grade fuel, has high calorific values and contains very little impurities. The sulphur content is extremely low, and so

it can be used in the most restricted air pollution control areas.

Being a gas fuel, LPG combusts completely giving a clean flame. It is widely used in domestic and industrial applications.

Physical Properties and Chemical Properties

LPG can easily be liquefied at room temperatures by the application of pressure. For example, during summer seasons in Hong Kong, LPG can be liquefied at a pressure of five atmospheric pressure.

When liquefied, 240 volumes of vapour are compressed to one volume of liquid. In other words, large quantities of vapour LPG are readily available in a small container containing the liquefied product. This feature is very important when we think in terms of storage, transportation and handling of LPG.

LPG is itself non-toxic, colorless and odourless. In order to detect the presence of LPG, say when leaking is suspected, some chemicals are added in, one example being methyl mercaptan, to give LPG the distinctive smell. It is noted, however, that prolonged exposure to methyl mercaptan can make people insensitive to the smell.

LPG in its vapour form is denser than air. It will therefore sink to low areas like pits and underground channels. This is why people are advised against storing and using LPG in cellars. If there is any leak, the LPG will be trapped in the cellar and it will be very difficult to disperse the gas.

Combustion can only take place when LPG is mixed with the correct amount (though in a wide range) of air. Too thin or too rich mixtures are not inflammable. The approximate range of LPG concentration that enables combustion to take place is 2 to 10 %,

which are called the lower and upper limits of inflammability respectively. Whether a good flame with the required heat output can be produced is the area where some technical know-hows are called for. The correct pressure, flow rate, burner design, air supply and other details all come to the play.

Storage and Transportation

LPG is stored under pressure in liquid phase. There are two types of storage-- bulk and packed. In bulk storage a bulk LPG tank is installed on the user's premises. Bulk lorries visit the tank on a routine basis to top-fill the tank. A distribution main will pipe the LPG in vapour phase from the tank to each individual user.

Another type of storage, packed, is used in many domestic units and factories where bulk tanks are not installed for a number of reasons:

(1) the consumption is low and a bulk storage is not justified.

(2) the space is limited; cylinders occupy much less space than tanks.

(3) government may not approve the installation of bulk tanks.

Packed LPG is supplied in cylinders with different capacities ranging from a few hundred grammes to over 50 kg. Most domestic users use cylinders of 8 kg to 15 kg in capacity. Industrial outlets usually use cylinders with larger capacities, for example 50 kg, because of their higher throughput.

Packed LPG requires less piping. The LPG cylinders are usually installed near the point of application, so only a short length of rubber hose is required to connect the cylinder to the appliance. One of the disadvantages of packed LPG is the need to replace the cylinder frequently. Empty cylinders are delivered back to oil

depots to re-fill. On-spot filling is not allowed. The average family may use two to three cylinders every month. Also, a lot of labour is required to deliver cylinders to the customers and to take the empty cylinders back.

Applications

LPG has a wide range of different applications. It can be used as a feed stock for chemical plant, or used on its own, in which case we may classified it into domestic or non-domestic applications.

Domestic Applications

Domestic applications are usually for food cooking and water heating. The Chinese is very fond of cooking with naked-flame, and LPG is ideal for this purpose. People have been using coal and kerosine for a long time, both being inferior to LPG in the strength of flame and cleanliness. Though the majority of people are using LPG in cylinders (in Hong Kong), there are increasing number of buildings supplied with piped gas from a common LPG bulk storage tank. People share the distributive network and each customer is provided with a gas meter to record the amount of LPG used. System-wise it is similar to town gas network, the differences being (1) the fuel is different, (2) piped LPG is a localised distribution system, while town gas network covers a much larger area.

LPG water heaters are readily available for providing hot water for bathing and washing purposes. People refer to gas water heater as instant heaters as compared to electrical heaters that heat up water gradually and thus require water storage facilities.

Amongst the domestic applications are some appliances not very common in Hong Kong. For example, LPG can be used in air conditioning, refrigeration and room heating. It is not very likely

that these applications will be widely adopted in Hong Kong.

Industrial Applications

LPG finds a number of applications in the food industry. It combusts completely and thus gives clean flames. The flame can be directly applied to food stuff without causing any contamination. In preparing bread, biscuits, instant noodles and roasted peanuts, LPG has been widely used. The high efficiency of direct flame often results in lower running cost than the traditional indirect heating using cheaper fuels like diesel.

In the production of ceramics and glass mosaics, the impurities level in the fuel has to be closely monitored because a slight contamination could result in the rejection of the whole batch of the final product. LPG proves to be one of the best fuels to be used in these industries. Consumption of fuel in ceramic plants is usually enormous.

The clean flame produced by LPG distinguishes itself from other fuels. To-day we can see its application in the can industry in the curing of can linings. The two-piece aluminium cans for beers and soft drinks are so commonly used consume quite a large amount of LPG. In the paper industry, the self-adhesive photo albums are cured by LPG. Carton paper that is used in packing also employs LPG in curing the adhesives binding the different layers of paper.

In the textile industry, LPG is used in the production of non-woven fabric, a material used in the inner lining of winter jackets. In the breaching and stone-washed jeans factories LPG is one of the major fuels in providing the heat source. In Hong Kong it is chosen against electricity because LPG is cheaper, and against diesel/fuel oil because the latter are under air pollution control which requires a costy high chimney to be erected for the flue

gases, thus minimising their viability though they are much cheaper.

In industrial establishments with staff canteens, LPG is often the only choice of fuel. More and more restaurants, whether Chinese or European, are using LPG as the basic fuel, showing that cleanliness has a good bargain over the higher cost.

In godowns fork lift trucks fuelled with LPG are rather common, mainly because diesel engines giving off uncombusted smokes cause a nuisance to people working in the confined godowns, and also cause problem in house-keeping.

Recently LPG also find some applications in the construction industry. Concrete usually takes quite a number of days to cure. Steam can be applied to the concrete to hasten the process. To draw a comparison, the conventional method of constructing building requires about seven days to construct one storey. If steam curing is employed, it takes only two days. Various fuels can be used to produce the steam, but LPG is probably the best amongst all because it is liquefied and easily portable on one hand, and will not give off black smokes on the other hand.

The above is not an exhausive list of the applications of LPG. In fact, the list can be extended to every industry that requires a clean fuel. In reality, however, the applications are limited for a few reasons.

(1) LPG is considered to be more expensive than liquid fuels. To a large extent this is true, except for large accounts to which a substantial discount is offered.

(2) LPG is new to some users. LPG was introduced into Hong Kong in 1962 and to SEZs only in the recent years. People who have been using solid or liquid fuel in the past tend to adhere more confidence in them and prefer them over LPG.

The properties of LPG are not well known to most users who in return rely on the suppliers to install, adjust and maintain the appliances. In the past every housewife knows how to maintain a kerosine stove, but the same is not true for LPG cookers.

(3) For bulk supplies a designated area for the installation of bulk LPG tanks is required. Whether the space is available and approved by local authorities will determine if LPG is considered.

(4) Local authorities may enact regulations limiting the use of gas fuel for safety reasons. For example, the Hong Kong Government has announced its intension to phase out LPG cylinders in favour for piped gas.

(5) LPG is facing strong competition with other fuels including town gas.

Despite the above limitation, LPG commands an ever increasing volume of sales in Hong Kong since it was introduced in 1962, partly due to the opening up of energy requirement base and partly due to its replacing other fuels like kerosine.

In SEZs, LPG was introduced only in recent years. (China has allocated a small quantity of LPG to SEZs prior to the entry of foreign oil companies into the areas.) No statistical data are available to deduce the exact amount of LPG consumed, but it can be assumed from observation that the amount is minimal and no substantial growth was evidenced until the oil companies based in Hong Kong entered into the market.

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